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TECH » SCIENCE » WHEELS » HOME » OUTSIDE

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Popular Mechanics

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EXCLUSIVE

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US FIGHTER ACES TRAIN
IRAQI TOP GUNS

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AMAZING?**

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BUYER, BEWARE

Water is the subject, if you'll excuse the excruciating pun, on everyone's lips. It certainly deserves all the headlines it gets. But it may for the moment have taken our eye off the 42 090-megawatt gorilla in the room: our electricity supply.

Perhaps because the past few months have been load shedding-free – and Eskom suggests this will continue – we might be lulled into a false sense of well-being.

The point is, the maintenance that we keep hearing about has to be done at some stage. When we get to that stage, many of us will be looking for alternatives.

Which brings me to a reader's plea. Energy alternatives are all very well, he says. Some of them are marvellous. But often they are not all they are made out to be.

What got me thinking along these lines was my first fumbling attempts at DIY home automation, which you can read about in this month's *Tested*. The point being that today's smart home gadgets not only do stuff, they also tell you stuff – such as how much electricity you are consuming individually. Being able to monitor this suddenly opened the floodgates to a whole new level of obsessiveness, with the ability to compare LED vs LCD and so forth, in real time, from anywhere on the planet, at 2 in the morning if you like (I was just checking my Whatsapp messages, dear).

I began to realise that, like the nation, my newfound interest in kilolitres had momentarily distracted me from the very important question of kilowatt hours.

And so to our reader. I had filed away his letter, written at the time in response to my June 2015 editorial, "Eskom, consider yourselves shed".

He noted my point that Eskom had betrayed the trust of all of us and that we needed to investigate installing solar electricity with immediate effect.

He had this warning, though: "But technophobes like me, who do not know the difference between a volt of electric potential and a bolt of lightning, actually listen to people like you; and we, in our ignorance, act on your advice and get ourselves into the most inordinate amount of trouble."

What was lacking, he said, was an element of *caveat emptor*. "Your articles make it all sound so easy – if you have the money, you just go out and get someone to install a fortune's worth of equipment on your roof, and there you have it. Exit Eskom. Your problem is solved. QED."

Do you know, it really isn't like that.

Instead, he says, he has been sitting with R300 000-worth of solar installation that has been seven months of nightmare.

Futuretech 2016

Finally, it seems to be coming together. With sponsorship lined up, a venue selected and a projected date of late April, you can look forward to a day of the cutting-edge and the mind-blowing at POPULAR MECHANICS 2016. Details, next month.

He conducted due diligence, contracted apparently government-approved capable suppliers ("genuinely NOT fly-by-night types") with engineers who spent many days inspecting and checking and pulling at wires and walking around with meters.

Well, he has moved on. Found another electrical contracting company. At R450 an hour. They have been hard at work and at the time of writing their bill had topped R15 000. Oh, they haven't actually done any *real* work yet – so far all they have been busy with is trying to work out what on earth the previous people installed.

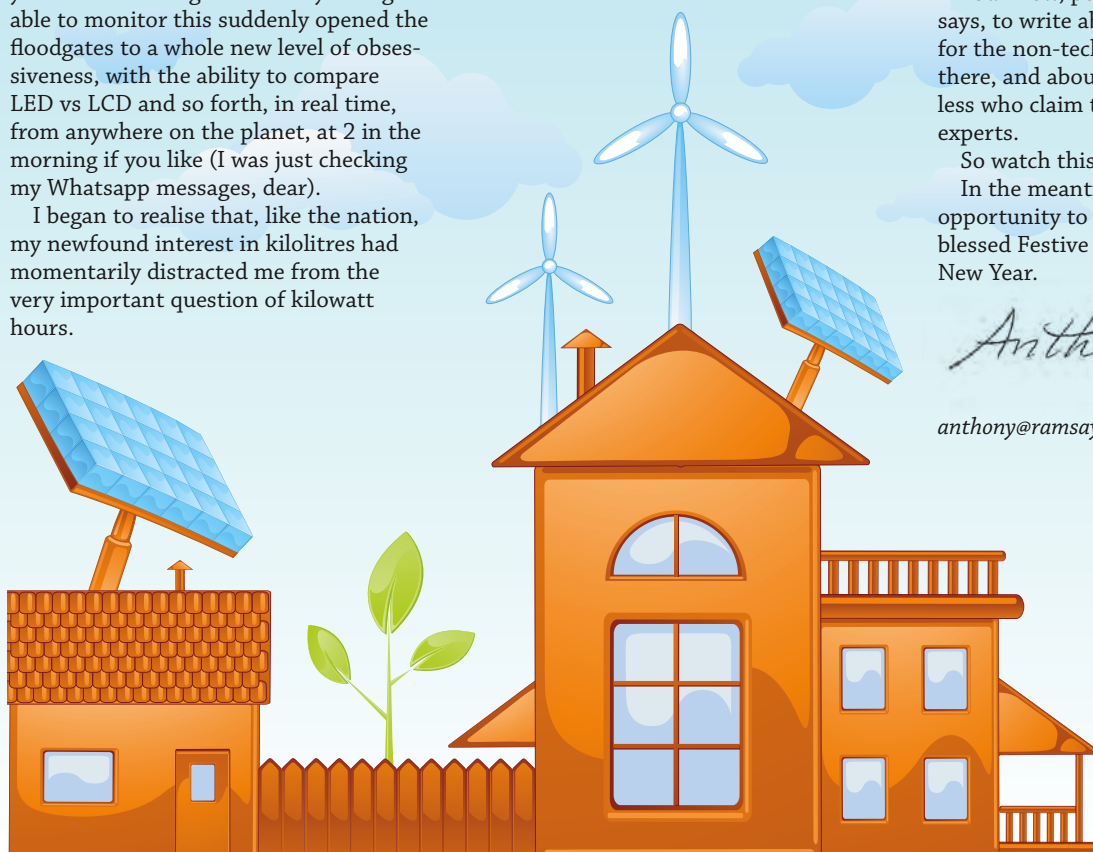
You know, perhaps it is time, as he says, to write about the perils waiting for the non-technical reading public out there, and about charlatans and the clueless who claim to be solar installation experts.

So watch this space.

In the meantime, I'd like to take this opportunity to wish you a peaceful, blessed Festive Season and a sparkling New Year.

Anthony

anthony@ramsaymedia.co.za



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WIN

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R12 000!

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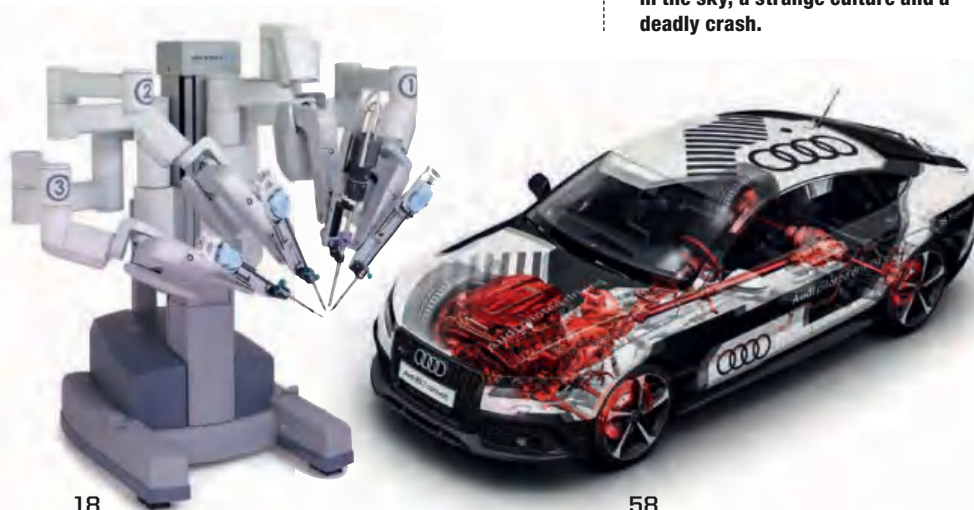
Cover and this page: A group of elite
Iraqi airmen are being trained in the
US to fly their country's first F-16s.
They have faced not only the task of
gaining familiarity with a formidable
fighting weapon, but also long hours
in the sky, a strange culture and a
deadly crash.



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PUBLISHED BY RamsayMedia (PTY) LTD

Company registration number: 1934/005460/07 ISSN number: 1682-5136

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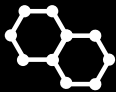
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WINNING
LETTER

TECHNOLOGY WILL KEEP MARCHING ON

Thank you for the eye-opening coverage of scientific and technology advances in *How Your World Works* of November 2015.

For the past couple of decades, the wealth and technological power of the human race has been increasing more or less continuously – starting almost precisely with the first voyage of Columbus in 1492 – and shows every sign of being likely to continue for centuries to come.

It is a situation in which the people of each century can look back to the time of their great-grandparents, even their grandparents, and observe with pride that they themselves are many times richer; that they can buy ever more marvellous goods ever more cheaply, many of which were unknown to the previous generation; that their lives are fuller; that they live longer; that they can travel increasingly long distances at a cost of an ever smaller percentage of their income.

There are two reasons for the inexorable advances in prosperity. The first is that most people are driven by a desire to better themselves, and the second is that all technologies have a continuous trend towards improvement. In short, when science is advancing, there are few public disasters that can destroy capital faster than private citizens can create it. And this rule works like a differential equation in physics. Change one value and you change the other. The faster science

advances, the more rapidly capital accumulates.

In richer countries, nearly every adult owns a car. A quarter as many own computers with which they can transmit or receive unlimited quantities of text and pictures through the Internet between all points on the globe, at no cost beyond that of a modem, the necessary software and the price of phone calls. People have flown in space, people have walked on the Moon, with the prospect that thousands more will do the same within the lifetimes of many now alive. How does that sound for “portentously rapid progress”?

It is not only disasters that bring about an acceleration of history. Almost any change in technology will do so, for technology feeds on itself. One of the most significant of these recent changes was the Apollo programme, which sent man to the Moon. For it created the modern computer industry, which, in turn, wholly altered society.

Nevertheless, what man cannot deliberately do, he may unwittingly help nature do for him. Many scientists are fascinated by the possibility that mankind will be succeeded by intelligent robots that will make us redundant. Many are actively trying to make this happen.

KRISH DE CHESARAE PILLAY
DURBAN



Write to us, engage us in debate and you could win a cool prize. In fact, this month we take that literally: our winning letter earns a Little Luxury Vitality water cooler valued at R1 250.

Water is on, well, everyone's lips, with drought and water quality among the biggest threats facing our society. For many, filtering their water has become second nature and with Little Luxury Vitality that process is easy and affordable. It's silly to have bottled water delivered to your house, at huge cost financially and environmentally, with diesel truck emissions adding to the pollution.

The Little Luxury Vitality water cooler is the most affordable true mini cooler. It provides 7 litres of ice-cold filtered water at your fingertips. Little Luxury Vitality cooler filters exceed both the USA and the European standards; they use NSF-certified filters, are tested by SGS France and approved by the FDA.

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Send your letter to: POPULAR MECHANICS, PO Box 180, Howard Place 7450, or e-mail popularmechanics@ramsaymedia.co.za Please keep it short and to the point. Regrettably, prizes can be awarded only to South African residents.

LEDs: STILL STUMPED

Thank you for publishing my letter (November 2015). In his response (December 2015) Kobus Stander laid the blame at the door of the 220 V to 12 V transformer. The trouble is, I am using 220 V LEDs and not 12 V ones, so no transformer is involved.

I read on the Internet that 220 V LEDs with a metal body don't cause this problem – mine are plastic. Perhaps if I wrap metal tape or tinfoil around the body to act as a shield...

I will let you know if this is successful.

ROBIN HAYES
BY EMAIL

TURN ON TO THE WEB

The answer to Robin Hayes's problem is simple: switch to Internet radio! All his favourite stations can be found there. If he still has a problem, then he should look elsewhere in his system for a fault.

ADRIAN WINSOR
BY EMAIL

NATURE'S WAY

The cow eats its food, digests it and then... “dumps” its load. Sounds boring, doesn't it?

Well, the “dumpings” of the cow are nutrient- and mineral-rich. After a few years,

that very spot where the cow “dumped” probably has better grass than the spots that haven't been dumped on.

Some of you might be thinking: what has this got to do with me? I'll tell you what.

That grass is eaten by a cow, digested by its body, turned into muscle and milk – and more “dump” is made. When the cow is ready, it is slaughtered and turned into meat. That's what it has to do with you.

What I am getting at is this: Nature has given us gifts, including the ability for “dumps” to be turned to compost, the cow's meat-factor and lots more. It would be a good idea for the big names in this

field (pun intended) to stop trying to make synthetic meat, to stop keeping cows in, frankly, torture chambers.

And it also makes financial sense. Why? Imagine if you've invested in a meat company, and one day you hear that scientists have been experimenting with synthetic meat.

Just imagine the outcry from the thinkers because, if it should (God forbid) succeed, cows, pigs, etc would become redundant – probably extinct. This, among other reasons, is why we should use our “dumps” for crops, use solar power and try to think of other ways to use Nature's gifts the way we where meant to.

WARREN CARLESS
BY EMAIL



FIRE AWAY

Let's start on a high note. PM is my absolute favourite mag, followed by *Guns & Ammo*. Sadly, I can only afford either but rarely.

The articles are fascinating, supported by reliable facts and figures.

Until now.

Your November 2015 report, “The future of the modern home”, includes a segment on security that features the Armatrix smart weapon (above).

Please do not emulate the majority of fiction writers, who show a pathetic – sometimes laughable – knowledge of firearms. If you want a good laugh, just mention silencing a revolver to a firearms enthusiast.

The pistol, as described in the text, does not have .22 bullets in a ten-round chamber.

What it does have is probably .22 ROUNDS in a ten-round MAGAZINE.

The bullet is the bit that exits the barrel on firing. It is contained in a metal case (usually brass) containing nitrocellulose propellant (note, not gunpowder), which is ignited when a blow is struck to a primer via a firing pin. The whole assembly is called a round of ammunition.

Not to worry, other august literary heavyweights – including Wilbur Smith and Ian Fleming – have made worse errors.

TIM PAINE
WIERDA PARK

MATCH, DON'T MIX

I enjoyed reading Angus Moodie's letter on piston speed, but got a bit mixed up with his quoting stroke and bore in millimetres and piston speed in feet. My calculations show a piston speed of 152 857,2 millimetres per minute (for a stroke of 93 millimetres). It's all a bit like the UK still being in pounds, gallons and miles per hour when the world generally is metric. One wonders how pieces for Airbus match when some are made in France.

DEN OSBORNE
BY EMAIL



GREEN NEEDN'T BE DIRTY

In “Don't kill the diesel” (December 2015), the section headed “The green alternative” says that biodiesel doesn't contain aromatics and other nasties found in diesel fuel and causes lower emissions.

The statement is only partially correct. Biodiesel does, in fact, emit higher NOx than diesel (see table below) for one litre of pure biodiesel compared with a litre of fossil diesel.

Biodiesel does provide a lifecycle reduction in greenhouse gas emissions of 76,4 per cent relative to average 2005 petroleum diesel fuel.

We, as biodiesel producers, are ashamed by the pictures used in the article. They create a perception in reader's minds that biodiesel is dirty and this does not encourage readers to want to use biodiesel, but rather discourages them from doing so. Your article unfortunately does more harm to the biodiesel industry than good.

If you want to obtain another perspective in the local biodiesel industry, we would welcome you to our biodiesel factory in Stikland, Bellville, Cape Town.

CRAIG WATERMAN
GREEN-DIESEL, CAPE TOWN



TABLE

Average change	PM	HC	CO	NOx	SO ₂	CO ₂
Percent reductions	-47,19	-67,36	-48,11	10,29	-100,00	-76,0
Pounds of emission reductions	-0,01	-0,01	-0,06	0,02	0,00	-18,80

ABBREVIATIONS

PM Particulate matter
CO Carbon monoxide
SO₂ Sulphur dioxide

HC Hydrocarbons
NOx Nitrogen oxides
CO₂ Carbon dioxide

PM



1947 Our ever-inventive readers are always finding crafty ways of doing things more cheaply, efficiently or weirdly. The tip pictured appears to fit all three of those categories: braze a hinge to a bilge pump as a footrest to make operation easier. What a pity that the efforts of our nattily attired but clearly sinking oarsman seem to have progressed well beyond the point of futility.

1937

What at first glance looks like a sun-bather in her shades soaking up some beats via her Beats is in fact a patient undergoing shortwave therapy for what are quaintly described as “ills”. The goggles protected against excess radiation from the quartz mercury ultraviolet lamp and the earpieces contained electrodes that radiated heat energy, or judging by her glazed look, possibly early Pet Shop Boys.



February 1967

Another decade, another US venture into foreign territories. This month's cover story involves a kind of warfare by proxy, but back in February 1967, the American foray into Vietnam was as personal as it got – and, inevitably, controversial. Whereas 2015's featured weapons platform is the F-16 and the target is ISIS, the 1967 version highlights what looks like the formidable Bell Cobra (which by the way is still in production) visiting righteous wrath on the Vietcong. It's hard to look at these images today and not be troubled by the fervour surrounding the 1967 issue's “salute to our fighting whirlybirds, including a two-page painting of them in action”. But, as they say, talk is cheap, war is an ugly thing and hindsight is 20/20.

1950 Memories of World War II may have been fading, but within a month of publication hostilities would resume in Korea. In the meantime, matters of a less militaristic nature were on the agenda, such as testing fishing tackle at California's Long Beach Tuna Club. Given the tuna's understandable reluctance to act as a guinea pig (guinea fish?) the anglers enlisted the aid of “mermaids” to swim off attached to special harnesses, testing – and sometimes breaking – the fishing gear. According to our story, club members “tell about the one that got away with added sighs these days”. **PM**





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HOW YOUR WORLD WORKS

HACKERS ► SURGERY TECH ► AUTOMATED FARMING ► POD TENTS ► GREAT UNKNOWNNS

TECHNOLOGY

THIRTY-SIX HOURS AT THE MOST IMPORTANT HACKATHON ON EARTH

Here's what happens when 400 prodigies and 1 500 cans of free Red Bull descend on Silicon Valley.

BY ALEXANDER GEORGE

← In two days, Timothy Su, 21, created an app that exchanges money between payment platforms, such as Venmo and Bitcoin.

EVEN INSIDE THE COMPUTER HISTORY MUSEUM, August in Silicon Valley is too warm for a hoodie, so most of the 400 young engineers and programmers gathered here are wearing graphic T-shirts and baggy gym shorts or cargo pants. Many wear running shoes, but some are barefoot, and almost all have slumped posture and unstylish haircuts. Speakers on tripods at the edge of the room play dubstep, bass-heavy electronic music that reminds one of the sound effects from video games. "It's like you're a machine!" one engineer exclaims. Work surfaces are covered with oversize monitors, ergonomic mice, empty cans, and Sun Chips crumbs. Every item in sight serves the sedentary, stress-fuelled, often solitary nature of inventing the future with ideas and a keyboard. This weekend, however, is anything but solitary.

This is Hack the Planet, an especially prestigious hackathon. But that word, hack, doesn't mean the same thing it does in news stories about data breaches at Bank of America or Ashley Madison. In the context of this event and the thousands like it that take place around the world, to hack means to create: a hackathon is an invention competition with a time limit. Participants have 36 hours to make a gadget or an app that improves lives.

As for what makes this event more prestigious than most: Major League Hacking, the organisation that hosts Hack the Planet and sanctions more than 150 hackathons every year, invited only university and graduate students and a handful of high schoolers who demonstrated both the creativity to come up with unusual ideas and the coding and engineering acumen to execute them. Jon Gottfried, an MLH cofounder, explains that he and the commissioners call up past winners and fanatical participants from other hackathons, but also entrants like Stefanie Cohen, 23, who's known for creative hacks involving visual art. The builders who meet these criteria are exceptional, which is why sponsors such as Microsoft, Oculus, and venture-capital titan Andreessen Horowitz give Major League Hacking the cash to rent the second floor at the Computer History Museum and hand out soldering guns and Bluetooth transmitters. In return, those companies get to scout for new hires. For the few who don't already have work lined up, meetings here often lead to full-time jobs after graduation or lucrative summer internships.

By 11:00 Friday night, a quiet chaos that will last through the weekend has descended over the hall. Some programmers work alone, but some form teams. A few met weeks before tonight through the event's Facebook group. Others met at the team-building session a few hours ago, at which one Hack the Planet organiser wrote participants' ideas on a whiteboard.

Brijen Thananjeyan, Krishna Bharathala and Jeffrey Chen, all 19, went to high school together. They take turns strapping an Oculus Rift headset around their heads, testing the virtual room they're designing in which users can draw on the walls. "The marks are pink," Bharathala says. "And I can't figure out how to change them."

Jenna Seco, 20, and Dan Stepanov, 24, who are dating, work with three other people on a calculator app that, when given the right number sequence, unlocks a secure messaging system for use in ISIS-controlled territories.



↖ Above, Fernando Faria, 22, tests an Oculus Rift system built by another hacker that teaches motor skills to people with cerebral palsy. At left, branded swag and hackathon fuel (Red Bull).

HACKED APPS

Impressive creations born at previous hackathons.



GroupMe

A group-messaging app that preceded now essential workplace chat providers, this was built at the TechCrunch Disrupt Hackathon in 2010. Skype bought it a year later for an estimated R611 million.



Workflow

Created at the 2014 MHacks at the University of Michigan, this app can trigger a set of functions under pre-set conditions, such as automatically uploading photos. It won an Apple Design Award.



Cosmos

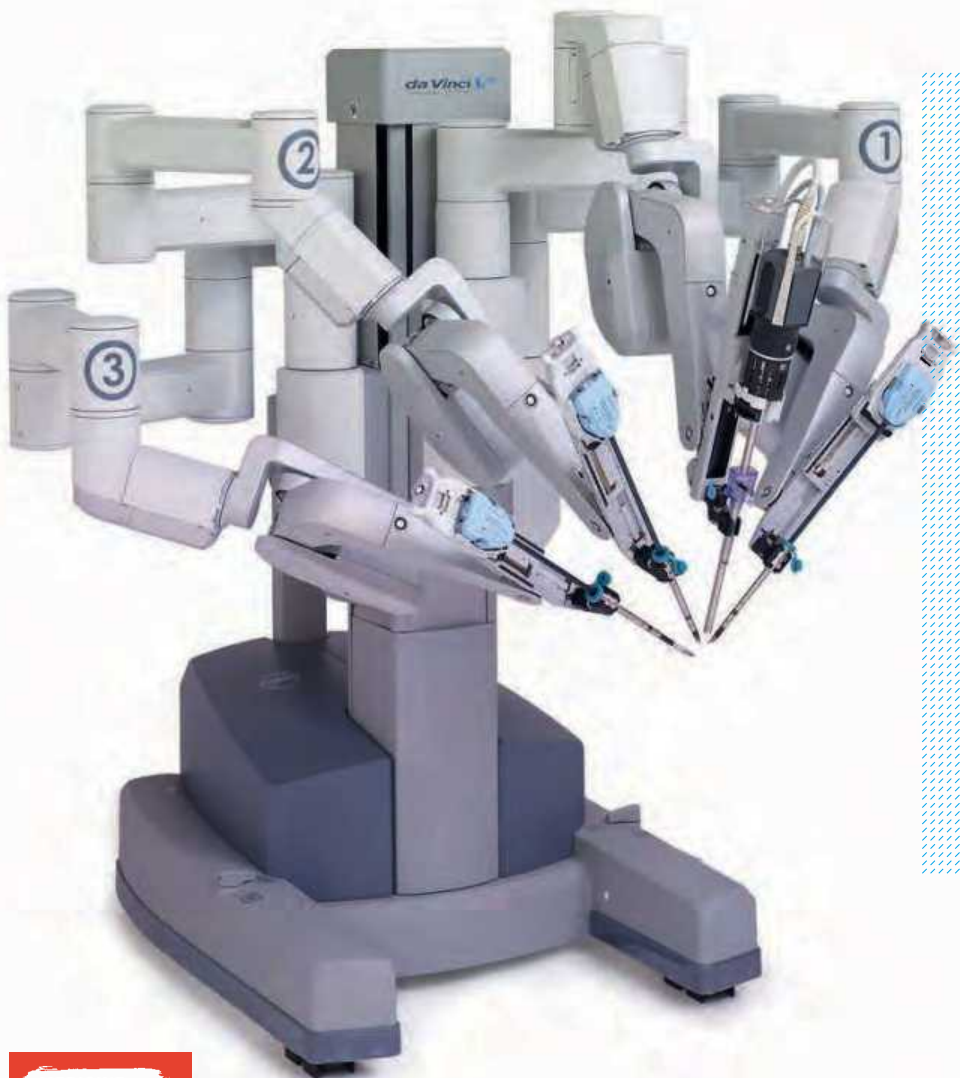
A team of four built this text-based Web crawler at a University of Michigan event and is now expanding it at an accelerator so exclusive that fewer than 1 per cent of applicants are admitted.

At the next table, Shariq Hashme, 21, Justine De Caires, 17, and Anthony Lobko, 19, are building a non-invasive glucose meter for diabetics, but the lightbulb that sends light through the finger to the sensor keeps melting the adhesive holding it in position. More experienced engineers stand by to help competitors who are stuck, easily spotted by their heavy sighs, rapid foot tapping, and muttered profanity. The mentors, barely older than the competitors, point out problems in their code.

A few competitors spend the entire weekend awake, like Shane Engelman, 27, a former US Air Force serviceman, or at least try to, like Aki Gao, 21, who drank five Red Bulls within the first two hours and 13 more over the course of the hackathon. Most sleep intermittently, either on pads in gender-segregated, darkened conference rooms or under the main room's fluorescent lights. Many of those napping are wearing Pebble-branded pajamas or resting on Microsoft-branded neck pillows – freebies.

Sunday morning, time is called at 10:00, and the programmers set up their creations like students at a science fair. Four finalist judges, veterans of the software and hardware industries, are looking for functionality, technical complexity, creativity, and whether they'd actually use the end result. They give top honours to an app that lets you make music with your voice while waiting on hold on the phone. Sponsors, who all offer their own awards, announce other winners. BMW's motorcycle division has the most coveted prize: a trip to the Munich headquarters to pitch the idea to management. That one goes to an app that links experienced motorcycle owners with curious newbies.

Participants are, or pretend to be, indifferent to the results. When asked whether he was upset about not winning the BMW prize, Engelman says, "That's not why I come to these things." Watching the intense collaboration happening around the room, you can see his point. A trip to Germany might be the highlight of a young adult's life, but the social communion among 400 people in the same place who enjoy talking about nodes and API – that is why they come. It's the chance to code and hack and solder, yes. Of course. It's the opportunity for internships and job offers. But really, they come for the humans.



Renowned robotic surgeon Dr Vipul Patel, who has led more than 8 500 robotic prostatectomies, speaks of being on the cusp of a surgical revolution.

DOCTOR ROBOT, I PRESUME

We're on the brink of a cancer treatment breakthrough

IN LATE OCTOBER 2015, surgeons at Pretoria's The Urology Hospital performed the country's first partial nephrectomy using robotics. In plain language, they removed part of a cancerous kidney – without laying a hand on the patient in the critical part of the procedure.

Using techniques honed through several hundred prostate surgeries at TUH, the pioneering medics see this as a breakthrough moment. One of the world's top urologists, on a visit to South Africa at the time, didn't mince his words either. Dr Vipul Patel, in the country for a conference hosted by TUH, spoke of being on the cusp of a revolution.

Robotics is now the standard care for many urological cancer procedures in the US, says Patel. And he should know. A noted writer on the subject, he is medical director of the Global Robotics Institute at Florida Hospital Celebration Health and medical director of the Florida Hospital Cancer Institute Urologic Oncology Programme, as well as holding multiple professorships. Patel has performed more than 8 500 robotic prostatectomies and leads one of the world's most experienced robotic surgery teams.

As it turns out, robotic prostatectomies (removal of a cancerous prostate) are well established in SA, too. TUH has undertaken 400 of the 700 total nationwide since introducing the technique two years with its R20 million Da Vinci Surgical System.

TUH urologist Dr Frans van Wijk explained that robotic kidney procedures would have

similar benefits to those of robotic prostatectomies. "Robotics is the most minimally invasive surgery available, resulting in much quicker recovery time, much lower blood loss and far less pain."

Africa's only urological specialist centre, the Urology Hospital has been in existence for 19 years. Its staff includes 20 leading urologists who use highly specialised technology, focusing on (among other things) prostate disease/cancer, kidney stones, bladder problems, urological cancer management, female urology and paediatric urology. Other common procedures besides prostatectomies include circumcisions, vasectomies and male infertility. The hospital works closely with the department of urology at the University of Pretoria Medical School.

Prostate cancer is the most common cancer in black South African men and the second-most common in white men, according to the national cancer registry. But it's not only in respect of cancer treatment that robotic prostate surgery is having a dramatic effect. Other spin-off benefits include lower rates of impotency: TUH's Dr Lance Coetzee says robotic surgery counters erectile dysfunction in prostate operations.



Before robotics, many men suffered from impotence, incontinence and a long and painful recovery after surgery. Now, thanks to the precision and minimally invasive nature of robotic surgery, vital nerves may be preserved more easily, significantly lowering the risk and incidence of impotence and incontinence. Other benefits include less pain, less blood loss, shorter hospital stay and a quick return to normal daily activities – sometimes within a week, compared with six weeks previously.

“Robotic surgery effectively preserves erectile function and urinary control in many cases,” says Coetzee. Because it allows vision and precision, if conducted properly, by well-trained surgeons, it reduces the chance of damaging vital nerves. He explains: “Previously, potency may have returned – sometimes only partially – over a period of one to two years with an average 50 per cent recovery rate. Now, we’re seeing erectile function often returning within one to three months, depending on the patient’s potency before the operation.”

Above:
The robot is steered from a console by surgeons.

Right:
TUH urologist Dr Lance Coetzee says robotic surgery has benefits for surgery as well as for recovery.



Previously, some men chose to live with prostate cancer, maintain potency and die from the disease, rather than undergo an operation and risk becoming impotent. That’s no longer necessary.

And there’s good news for women, too: the robot could also be used for a range of gynaecological procedures. Talks are under way with medical aids about covering the costs of the operations.

● Source: TUH

OPERATING WITH ROBOTS: surgeon's-eye view

IN PROSTATE REMOVAL SURGERY, using robotic methods is described as being the least invasive method there is. It typically involves five keyhole incisions in the abdomen; those small incisions mean faster healing, less scarring and less risk of infection than traditional open surgery. At the same time, there's better access to organs, tissues and nerves. According to TUH, the surgeon experiences magnified 3D visualisation plus increased precision, control and range of motion. Thanks to the Da Vinci system's better ergonomics, surgeon fatigue is reduced.

TUH urologist Doctor Francois du P Boezaart takes us through the process.

PM What are the essential components of robotic surgery? Who does the physical work on the patient?

We use the robot to do robotic assisted laparoscopic radical prostatectomies (for localised prostate cancer). This device enables the doctor to do more accurate surgery laparoscopically. The robot makes the procedure easier to learn. The improved 3D vision, as well as the ability to set the sensitivity of the device, makes the surgery more accurate. This device works on a master-slave principle: the surgeon works from a console.

PM To what extent is the robotic part automated or, in fact, autonomous?

The robot does not do the procedure by itself, but is steered from the console, where the surgeon controls everything. The slave part is at the patient's bedside and consists of robotic arms that are inserted via small incisions (about one to two centimetres long) through trocars put into the patient's body.

The operation is then done by the surgeon sitting at the console. The advanced flexibility and mobility of the small robotic instruments inside the patient's body make for very accurate and concise surgery to be performed. All tremors of the steering hand would also be filtered out, resulting in absolute stability of the robotic instruments inside the patient's body. No action of the robot is performed without it being steered by the surgeon. Thus there is no automated functionality.

PM Can it be done at a distance (say cities apart)?

The surgeon at the console works mostly in the same theatre, but can also do so in a different setting, depending on the quality of the broadband connection (even on a different continent).

PM Where does robotic surgery fit into the medical liability scenario?

The doctor performs the procedure and would ultimately be responsible for surgical outcomes. The device is merely a tool to improve visibility and accuracy of surgery as mentioned above. There are, however, medical legal cases all over the world in which patients have sued the company or the doctors involved, or both, where complications have arisen. These, however, are few and far between. The robot in general enhances the doctor's ability to provide quality surgical care.

PM Why has robotic surgery become a focal area in treating prostate cancer, specifically?

The robot has become the primary device used for radical prostatectomies in the US, where more or less 90 per cent of these procedures are being done with the help of the

robot. The remaining 10 per cent are being done pure laparoscopically or by open surgery.

In South Africa we have four robots at present. The first was installed at TUH in Pretoria in October 2013. To date we have done more than 400 robotic assisted laparoscopic radical prostatectomies.

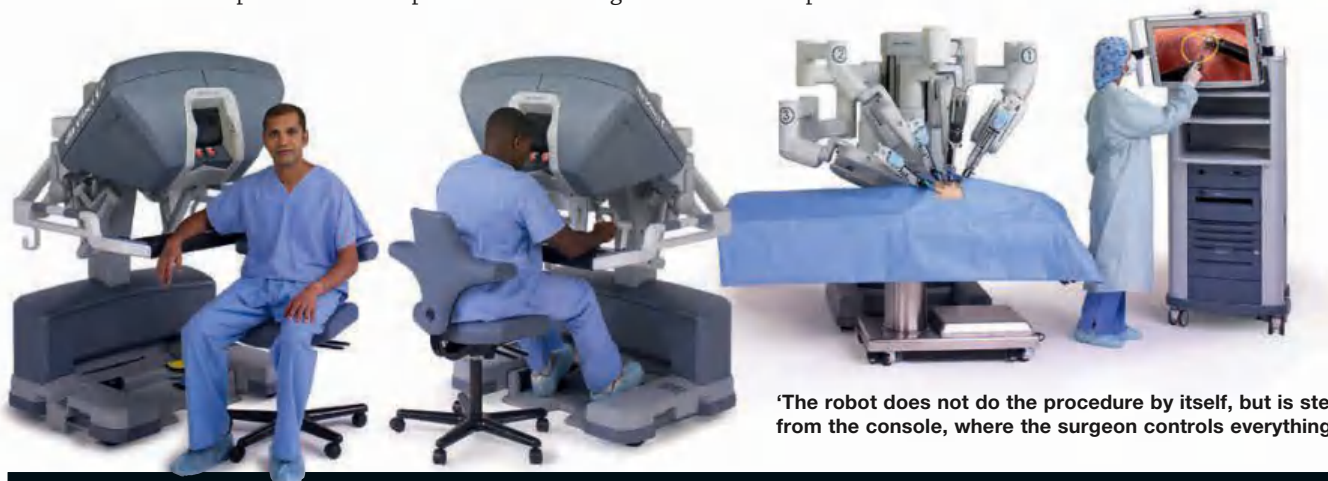
PM What are the alternatives?

There are alternatives available. In terms of surgery as mentioned above, it can also be done laparoscopically or via open surgery. The laparoscopic approach is technically very difficult, with a very steep learning curve. Only a very few urologists in the country are able to carry it out. At our hospital we have done more than 1 800 laparoscopic radical prostatectomies, but the steep learning curve (the difficulty of acquiring the skills) makes this procedure less viable for general urological practice. This is where the robots step in to make the procedure more readily available in terms of minimal invasive surgery. Open procedures are still being done, in many cases, in South Africa.

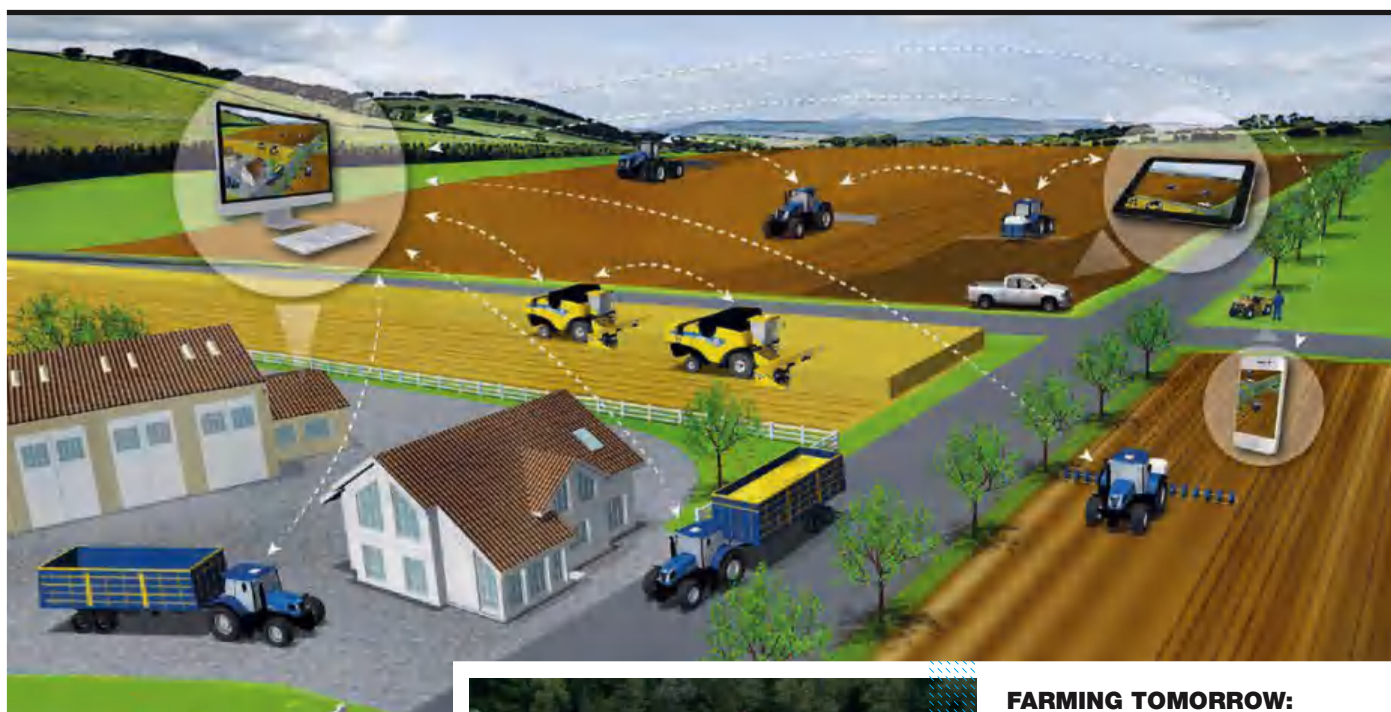
As far as non-surgical alternatives are concerned, radiotherapy is currently the only viable alternative. It is generally reserved for poor surgical risks patients and those patients who prefer the non-surgical approach.

PM What special training is needed?

There is in place a well developed programme in learning the technique. At present, robotic surgeons undergo basic training overseas. They have to complete modules as they progress to the actual procedure. The first five to 10 cases are done under supervision of a proctor. We have a simulator available through which the skills can more easily be acquired. The different modules that I have mentioned would also encompass simulated training.



'The robot does not do the procedure by itself, but is steered from the console, where the surgeon controls everything.'



THE NEW AGRICULTURAL REVOLUTION

Sustainable farming for future generations won't just be about genetically modified crops.

AN ALTERNATIVE-ENERGY ENGINE, assisted steering and navigation system are what you would expect to find on today's high-tech vehicles. But new-generation farm implements are finding themselves right up there on the frontiers alongside smart cars.

A prototype alternative-fuel tractor could change the face of sustainable farming tomorrow, says farming machinery manufacturer New Holland – and the company's driver-assistance systems are already doing so today.

The methane-powered tractor was showcased at the recently concluded 2015 Expo in Milan, Italy. With the theme "Feeding the planet, energy for life", the Expo hosted more than 850 000 visitors.

A second-generation prototype, the tractor is seen as a hint of a future in which farms can be energy-independent and more environmentally friendly. Based on a standard New Holland T6 tractor (above and right), it is powered by a natural gas engine manufactured by a



New Holland associate, FPT Industrial.

The tractor underwent real-world testing at the La Bellotta farm in Venaria, Italy. That's also where the company is deploying its Energy Independent Farm concept. The objective: to generate the energy the farm needs from the crops it already grows, alongside recycled waste by-products. "With biogas innovation, we have been able to restart investment and re-employ people. This is the result of a virtuous process," says Luca Remmert, owner of La Bellotta.

● Source: The Newsmarket

FARMING TOMORROW: PRECISION LAND MANAGEMENT

New Holland says its Precision Land Management (PLM) technologies (above) are revolutionising agriculture. "They are becoming an essential tool for many farmers as they strive to reduce input cost, improve yields, and increase efficiencies," says the company's PLM product specialist, John Downes.

New Holland's PLM offering includes displays, guidance and telematics systems, mapping software, crop input control systems and data management software – even steering assist.



+ NEW-WAVE TRACTOR: GROW YOUR OWN FUEL

Fuel cost savings of between 20 and 40 per cent are forecast for the Methane Power Tractor. It has 80 per cent lower polluting emissions than a standard diesel tractor and complies with future greenhouse gas targets in Europe, expected to impose a 20 per cent cut in emissions by 2020.

Even better, using biomethane (derived from biomass) cuts overall CO₂ emissions further. An Energy Independent Farm could grow the biomass and recycle its waste byproducts to produce its own biomethane, eliminating CO₂ emissions and slashing fuel costs.



CAMPERS UNITED

Modular connected tents help foster the spirit of togetherness

TENT VILLAGES AT MUSIC FESTIVALS are masterpieces of instant community planning. But even though the tents are all clustered together, the fact that they are separate entities can militate against a true spirit of togetherness (some, of course, would consider that a distinct advantage).

POD tents of the UK (podtents.com) solved that problem by designing modular tents that can be connected in unique formations. It's an idea that appears to have taken off in a big way in the UK, Europe, South Korea, the USA and Australia since the concept was launched about a year ago. The good news for local festivalgoers is that POD has set its sight on global markets for 2016, with the launch of its new Elite range scheduled for early in the new year. Improvements to the Elite range include better UV protection, lighter weight and more durable design.

The inaugural range of tents included the POD Maxi and POD Mini, for sleeping eight or four people together in one tent with separate rooms. POD tents can be externally and internally adapted to create communal living spaces and private sleeping pods for large groups. Each POD can be connected to another, allow-

ing huge groups of revellers to camp together.

"Personal sleeping pods allow the privacy of a separate tent, but the connecting corridors and tunnels help to keep everyone together and can create unique communal areas that groups of friends will lose at a festival," says Jason Thorpe, director of POD Tents designers M2C Innovation.



GREAT UNKNOWN

**BIG QUESTIONS.
ANSWERS YOU CAN'T
FIND ON THE INTERNET.**

Q



How many AA batteries would it take to start a car?

A AA? WE PREFER SIMPLY AA – as in the Automobile Association, which, for a nominal yearly membership fee, will gladly send a mechanically inclined gentleman in a well-equipped truck to start your car for you if you ever get jammed up with a dead battery. But maybe you're stranded outside an Eveready warehouse with no phone service or you're just determined, for reasons of your own, to get all MacGyver with it. Here's what you need to know:

No. 1: This is an impractical idea. It would be difficult, expensive, and possibly dangerous. We do not recommend it. No. 2: It is possible. Let's start with what we might call the "perfect case". Professor and automotive engineer Giorgio Rizzoni of Ohio State University lays out the following assumptions: the car employs a standard 12-volt battery, and the temperature is above freezing. Starting the engine will require 250 amps for a half second, and the most current a 1.5-volt AA battery can produce is 10 amps. Given the above, you'd need to start with a string of eight AAs to get your necessary 12 volts. However, to produce the necessary current (250 amps) you'd need 25 parallel strings of eight AAs ($25 \times 10 \text{ amps} = 250 \text{ amps}$). So, in a strictly theoretical world, 200 AA batteries ought to be able to start a typical midsize car – once.

Stepping out into the real world (which

we really ought to do more often) we need to account for an inopportune property of electrical connections: they bring with them something called resistance. In short, every connection demands more current, and if you're soldering, welding, wiring, whatever, 200 AA batteries together, then hooking them up to your car's starter motor, you're going to need a lot more juice along the way. That means more batteries. How many? Lots. The calculations are too complex for this space, to say nothing of our liberal arts background, and involve a bit of technical guesswork. But various reckonings suggest it might actually require anywhere from 1 200 to nearly 5 000 AAs in total to crank up old Bessie. Given that, you'd be better off selling the batteries and using the money to buy a car that starts.

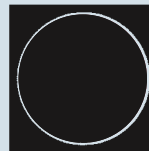


When lightning strikes the ocean, how many fish die?

Fewer, perhaps, than die when one dumps an ancient Ford Cortina with a bootful of AA batteries into the ocean out of frustration that the bastard still won't turn over. Indeed, fish tend to lead short and brutish lives, but lightning is way down on the list of threats they face.

For one thing, and this may surprise anyone who has seen the intro to *Gilligan's Island*, lightning storms at sea are not all that common. The farther offshore you go, the rarer they get. Ask a scientist why this is and you'll hear a variety of theories that,

when you sum them up, equate roughly to "beats us". In any event, salt water is a good conductor (that is, it has low resistance), which means that when lightning does strike the ocean, it spreads quickly on the surface and disperses. Don MacGorman, a senior scientist at the USA's National Oceanic and Atmospheric Administration's National Severe Storms Laboratory, says that unless a fish is right underneath a strike and swimming at a depth of less than 3 metres or so, it's probably safe. Consider this, though: a 2013 NOAA study found that 64 per cent of lightning deaths since 2006 occurred while people were participating in "leisure activities". The deadliest? Fishing.



Will we ever have Star Trek-style teleporters? How will they work?

Never say never, though from today's scientific vantage point, it's hard to see how we'll bridge the gap from the dreaded depredations of Boarding Group 4 to the breezy convenience of "Beam me up, Scotty." But, hey, let's dream for a minute.

There have, in fact, been successful experiments in something called quantum teleportation, in which the information contained in one atom is transferred to another, effectively replicating the first atom in another place. "That would be fine in a *Star Trek* sense," says Steve Rolston, codirector of the Joint Quantum Institute at the University of Maryland, "except when I do it with *Star Trek*, I have to do it with however many atoms are in you." Which, Rolston adds, amounts to "more information than we would ever have any possibility of keeping track of."

Even if that hurdle were overcome, human teleportation would be quite a bit messier than the shaft of swirling jelly beans seen on TV. You'd need some kind of medium on the arriving end – a blob of carbon, oxygen or nitrogen – just waiting to become your winsome smile, gruesome toenails, and everything in between. And what would be left on the other end? Another blob. Gross.

Fear not, however. Professional futurist Michael Rogers argues teleporters will soon be unnecessary, thanks to the developing field of "telepresence", in which far-flung robotic avatars connected to our senses will enable us to "be" anywhere we like without ever leaving home. At last, a truly practical use for all those AA batteries.

PM

GREAT **NEW** STUFF



Disney Infinity 3.0

Part toy box and part video game, Disney's Infinity is all-ages fun and an expensive nightmare for collectors everywhere. Following in the footsteps of Skylanders and bringing toys to life on your TV screen, the playsets consist of a base station that you plug in to your console of choice. The compatible characters are then placed on the base. You can choose to play in Play Set mode, where you help the characters achieve various goals within a relevant story line; or Toy Box mode where you design your own play world and choose any characters to join in the fun. Infinity 3.0 launched the Star Wars franchise on the platform (with *Force Awakens* characters released to coincide with the movie) and Disney hasn't been shy to add popular characters from their latest animated movies *Inside Out* and *The Good Dinosaur*. Gameplay and visuals are geared towards the more childlike, but it is a great alternative to the realism found in the first-person shooter realm. It's a hoot for most ages and will work on Wii U, Xbox (360 and One) and PlayStation (3 and 4).

Starter packs cost R700 and can be found at most retailers where games are sold; visit infinity.disney.com for more.



Huawei MediaPad M2 8.0

The Chinese electronics giant has gone audio-heavy on its latest 8-inch media consumption device. Harman Kardon was enlisted to tune the two 1W stereo speakers, which sound good piping out of the metal unibody design. One for the enthusiasts. From R9 400, consumer.huawei.com



Samsung Galaxy Note 5

The king of the big-screen Android phones returns for a fifth instalment of market dominance. Purists who like their Google-powered handsets unadulterated will turn to the Huawei-made Nexus 6P for phablet goodness, but this is the phone that started the trend. Samsung doesn't shy away from innovation with a redesigned (but still class-leading) S Pen stylus that comes with added functionality like taking notes with the screen turned off. The beefy Exynos 7420 chipset handles processes with an eight-core monster unit and is supported by 4 GB of RAM. Screen size is 5,7 inches and it's of the 1440p (QHD) Super AMOLED variety. On main camera duty is the superb 16MP snapper with optical image stabilisation and a decent 5MP unit. This is easily the best Android phone for most power users despite the negative press about no expandable storage and a sealed battery.

You can get a 32 GB model for around R10 400, but the 64 GB is the one you want. Visit samsung.com for more info.



Apple MacBook

A redesigned slim keyboard (with butterfly switches), a solitary USB type-C port and pressure sensitive Force Touch trackpad set this apart as the most interesting laptop of 2015. Much more than a glorified iPad.

From R22 000, istoreonline.co.za



Apple iPhone 6S

If you prefer your phone in fruit flavour, the iPhone 6S (or Plus variant) is the best in the business. The new 12 MP rear camera and pressure-sensitive screen are the hardware features to own and it makes a solid case for an upgrade. Sorry, new iPhone 6 owners.

From R11 800, istoreonline.co.za

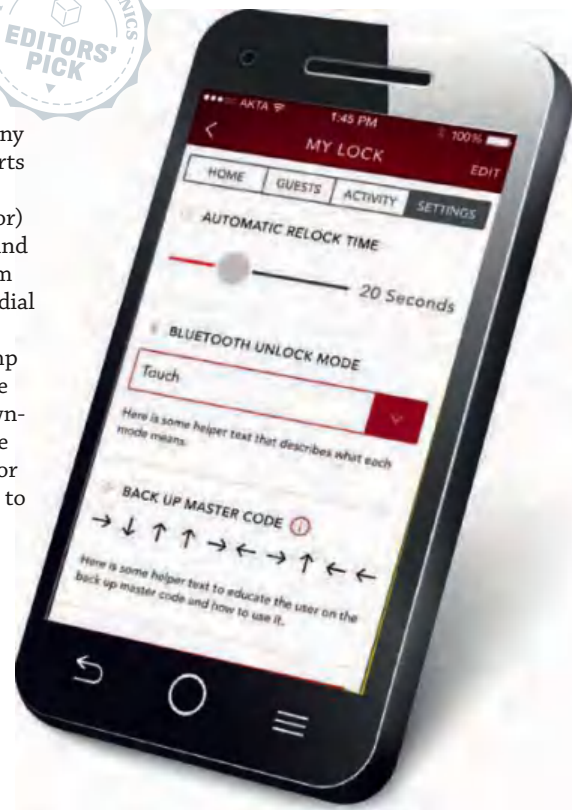




Master Lock Connected Padlock



Using your smartphone to unlock things is old hat, but for a company with a reputation for security like Master Lock, it's huge. It all starts with an encrypted app called Vault that you use to pair with the Bluetooth-enabled padlock. The two variants (outdoor and indoor) work in much the same way, although the outdoor one is taller and has a 51 mm Boron shackle. You can unlock it via Bluetooth from an app-authorised phone or use the four-way directional pad to dial in the back-up sequence. Power comes from a CR2 lithium coin battery with a minimum life of one year, and there's a clever jump start terminal system if the battery dies while locked. Within the app you can share access to the lock (requires other users to download the app), track the lock activity, schedule access and manage the back-up directional password. In all it's a great progression for the padlock industry and we'd love to see the technology extend to bicycle U-locks. The indoor model will set you back R2 000 and outdoor model R2 600; see mackiediy.co.za for more.



WD My Passport Pro

You'll love the rapid data transfers - 3 GB file in 34 seconds - but hate that it's only for Apple fans, or for hectic gaming systems that have a built-in Thunderbolt port.

From R4 200, wdc.com



Canon EOS M10

The famed camera company has finally figured out how to make good compact mirrorless units, and this is one for the masses. It's packing an excellent 18 MP APS-C sensor, Wi-Fi and NFC, so your Instagram shots are easier to share from camera.

From R4 600 (body only), canon.co.za



Airwheel M3 SkateBoard

Skating as an adult is only a good idea if you haven't stopped skating since high school. If you have, this is right up your alley. Airwheel are champs at Segway-type devices, so the M3 is self-balancing and can hit a max speed of 18 km/h. Lithium-ion batteries hold charge and you control the power via remote control.

R8 000, airwheel.net

DIY 7-in-1 Solar Space Fleet Kit

Toy-building kits are more about learning skills than about having fun, but both happen at the same time. This model kit comes in six unit parts and can be Voltroned together to form one giant robot. The rechargeable battery can switch between the different toys, or you can opt to use the solar panel which will recharge from sunshine or a halogen light source. There aren't remote controls, but enquiring minds will love the intricate construction details and how everything works together. Also, there'll be the hours of bonding time under the festooned tree to look forward to when the receiver wants to play with all of it now. Get this set for R400 at mantality.co.za



Tribe Star Wars USB Flash Drive

While we don't condone piracy, it would be awesome to have a copy of the latest Star Wars *flick* on one of these. Sizes max out at 8GB, but the force of novelty value is strong with this one.

R250, thegadgetshop.co.za



Desk Pets

Charge it via USB and use your phone as the remote control. It's like the Micro Machines of our time, but without the fast-talking TV ads.

From R400, thegadgetshop.co.za

Homido Smartphone Virtual Reality headset

Getting a virtual reality experience on the cheap is easy with Google Cardboard, but those units don't last very long. This unit is a great platform-agnostic solution that you can buy now and connect to your smartphone, instead of waiting for Oculus.

R1 500, mantality.co.za





WD Black 3TB

The performance car of hard drives does away with the hybrid SSD configuration and instead rolls with discs that spin at 7 200 r/min (just shy of the torque peak on a VTEC engine). This is robust storage for high-demand systems.

R2 500, wdc.com



Razer Mamba Chroma

You may think it's the pulsing LED racing stripes or the superior grippiness that sets this mouse apart from the competition, but you'd be very wrong. The Mamba's magic is something you can't see: the invisible 16 000 DPI laser tracker. Adding customisable LEDs was a purely aesthetic move to justify the Chroma name, but the wired/wireless functionality is a hoot especially since the charging stand doubles as the wireless receiver. Razer promises precise motion tracking and response that will shame your official office equipment more than a naked walk to the Red Keep, but the adjustable click force doesn't really change much. Still, the grippy rubberised texture is quite pleasing and the ergonomics are spot on. If it's good enough to keep gamers happy, your eight-hour slog will be quite comfortable. Yes, the battery can last that long. Available at most PC hardware outlets for R2 500; visit razerzone.com



LG 29-inch 21:9 UltraWide monitor

Though we're a little against having to move your head to follow the action in a game, this landing strip is decadent in its abundance of crispy pixels. The 2 560 x 1 080 resolution holds up well and you can definitely describe the experience as immersive.

R6 500, lg.com



Unilite Prosafe Inspection light

From the blinding unboxing experience to finding Barbie's shoes under the bed, this inspection light has earned its place in my life. The nine LEDs all burn at once, powered by three AAA batteries, and can switch between strobe, dim and bright.

R320, uni-lite.com

PM

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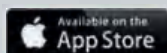


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RIGHT NOW, ON A MILITARY BASE IN TUCSON, AMERICAN FIGHTER PILOTS ARE TEACHING A GROUP OF ELITE IRAQI AIRMEN HOW TO FLY THEIR COUNTRY'S FIRST F-16S.

IN THE US THEY'VE FACED A STRANGE CULTURE, LONG HOURS IN THE SKY, AND A DEADLY CRASH.

BACK HOME LOOMS A GREATER CHALLENGE, THEIR ULTIMATE TARGET: ISIS.



BAGHDAD, ARIZONA

●
STORY AND
PHOTOGRAPHS BY

**ELLIOTT
WOODS**

OVER

FOUR DAYS IN EARLY SEPTEMBER 2015, Iraqi fighter pilots carried out 15 air strikes against Islamic State targets in Salah ad Din and Kirkuk provinces, just north of Baghdad. The story didn't get much play. Five short sentences in the Associated Press, with a canned quote by a Pentagon spokesman and few details. None of the major news networks paid any mind. *The Guardian*, one of Britain's leading daily newspapers, presented a marginally fuller picture: the planes were American-made F-16s, among 36 ordered by the Iraqi government back in 2011. The United States had repeatedly delayed delivery of the jets, citing safety issues as the Islamic State group, or ISIS, became a direct threat to Balad Air Base – the jets' future home. Of course, ISIS was the very

reason Iraq now needed the planes urgently, and eventually the first four arrived in July. Still, *The Guardian* largely dismissed the delivery of the F-16s – the first ever in the history of the Iraqi Air Force – saying they would not be “a game changer” in the fight against ISIS.

It had been more than a year since ISIS had captured Mosul, Iraq's second-largest city, prompting the intervention of a coalition led by the US. Air strikes had targeted ISIS territories for much of that year. So you could understand how the news media didn't think 15 more carried out by four Iraqi planes would change the fight in a fundamental way. But how those pilots came to be flying those airplanes in the skies over their home country – that was a big change indeed. The men flying the F-16s had recently returned to Iraq from a base in Tucson, Arizona, another desert more than 12 000 kilometres from Baghdad, where they had completed more than three years of training with United States Air Force pilots. They had lived among Americans, eating tacos at Mexican cantinas, trying to follow the NBA. They had missed their families, their own beds, the mothers' home-cooked meals, their hometowns. These men, who back in Iraq had learnt how to fly in Cessnas and Beech-craft T-6 single-engine prop training planes, now knew how to control the mighty F-16 Fighting Falcon, a multimillion-dollar, Lockheed Martin-built military combat machine that can reach speeds of 2 400 km/h.

And they weren't the only ones. Back in America there were others. Around 20. Iraqis just like them, learning to fly F-16s, training to fight ISIS. Though that number was one less since June, when one of those men had died.

No, in the 24-hour news cycle, four Iraqi Air Force pilots flying some bombing runs in a confusing and far-off war didn't merit a mention in the crawl along the bottom of your television screen. And yet to the pilots who flew the missions, and to the rest still in Tucson counting the days before they could return home to do the same, and to their wives and children and mothers and fathers, and to the family of the man whose F-16 crashed in an eruption of flames in the Arizona desert just days before he was supposed to return to Iraq to help lead the fight – to them, it was everything.



An F-16 in the 162nd Wing's “hush house,” a soundproof hangar where engines are tested.

LEAST VALENCIA ROAD, a 10 km stretch of shopping centres, butcheries, industrial parks and chain hotels, runs alongside Tucson International Airport. Three years into their training programme, the Iraqi pilots have done their best to fit in here. They live in small apartments near the airport, on the city's south side. Some drive American muscle cars, bought with their pilot salaries. The younger ones have discovered Congress Street, a downtown district full of craft breweries and tequila bars where University of Arizona students go on the weekends. They've also discovered Las Vegas.

The weather is like home, pretty much – dry and hot most of the year, except for a few weeks of summer thunderstorms that locals call the monsoon. The reliable climate makes Tucson a great place to fly. Only three per cent of all sorties are cancelled due to dangerous conditions. Take away the towering saguaros and the Sonoran desert looks a lot like Iraq – especially from the sky. But on the ground America is so much different.

Its mix of skin colours. Everyone free to go about their business – the children, the groceries, the job, the errands, the night out, the sick day, the golf game, the business trip, the oil change, the early-morning meeting – without worrying about suicide bombers. The Iraqi pilots move among a population unaware of where they're from, of who they are, of what they're doing.

Nawaf has been in the US since 2011. (Nawaf is not his real name. For the protection of his family, his colleagues, and himself, the Iraqi Ministry of Defence allowed him to be interviewed only on the condition of anonymity. Neither would they permit photography of him or the other pilots – or even provide the exact number of pilots in the F-16 training programme, though earlier news reports estimated 24.) His family – mom, dad, a sister and two brothers – lives in Sulaymaniyah, though for most of Nawaf's life they lived in Kirkuk, just under 120 km west, an ancient city as famous for the diversity of its population as for its oil fields. Arabs, Kurds, Assyrians, and Turkomans, Christians and Muslims, Sunni and Shia all live there. Nawaf is a Kurd. Now 25, he was barely a teenager in March 2003, when one thousand members of the US Army's 173rd Airborne Brigade parachuted into Kirkuk to open the northern front in

the Iraq War – one of the largest airdrops since World War II. In 1988, near the end of the Iran-Iraq war, Saddam Hussein fatally gassed thousands of Kurds. Nawaf's family and neighbours anticipated a similar attack in response to the American invasion. "We were afraid Saddam would do something terrible," he says. "We made gas masks and prepared our cars to flee the city. The car had to be ready with everything in the trunk, even food, 24/7." The chemical attack never came, and Kirkuk was quiet in the early years of the US occupation.

Violence increased as Nawaf got older, but that's not why he enrolled in the Iraqi Military Academy in 2008 as an Air Force candidate. His father had been a conscript in Saddam's army and wanted to be an Iraqi Air Force pilot, but there was no chance.

Nawaf's father was a Kurd, and Kurds were not allowed to be pilots. "I'm doing this for my dad," Nawaf says.

In September 2011, with American forces pulling out of Iraq and taking their air superiority with them, Iraqi Prime Minister Nouri al-Maliki purchased 18 brand-new F-16s from the US with the goal of rebuilding an Iraqi Air Force capable of defending its own airspace. Two decades earlier, Iraq had been the most feared air power in the Middle East, with more than a thousand aircraft mostly obtained from the Soviets and the French. But after Saddam invaded Kuwait and the Gulf War began, nearly all of Iraq's aircraft were destroyed by the Americans or flown to Iran, first by defecting Iraqi pilots, then under direct orders from Saddam. The ensuing no-fly zones further curtailed the Iraqi Air Force and the 2003 American invasion completed

its destruction. By 2004, the Iraqi Air Force had just 35 personnel and zero aircraft.

In December 2011, al-Maliki ordered another eighteen F-16s, bringing the total cost to around \$6 billion. This sum included the jets themselves, along with a standard package of 20 mm Vulcan cannons, hundreds of missiles and laser-guided bombs, targeting pods, and all necessary communications and navigation systems. The per-unit sticker price of roughly \$165 million included sending pilots to America for F-16 training. A group of six came first, the others arriving in small groups over the months that followed.

They started at San Antonio's Lackland Air Force Base, where they spent four months learning English. Then it was on to Laughlin Air Force Base in Del Rio, Texas, where they took Undergraduate Pilot Training – the Air Force's introductory flying course – proving themselves on the single-prop T-6 Texan II. From there, they advanced to the dual-jet T-38 Talon at Columbus Air Force Base in Mississippi. Then it was back to San Antonio, this time to Randolph Air Force Base, for eight more months in the T-38, practising evasive tactics and air-to-air combat. Finally, they headed to Tucson International Airport, home of the 162nd Wing of the Arizona Air National Guard, for the final phase of training in their very own



The view from a two-seater D-model F-16.

Brigadier General Hasan in his F-16, the same in which he would fatally crash.



F-16s. The instructors here are some of the most skilled fighter jocks alive, having flown combat missions in Iraq, the Balkans, and Afghanistan, and averaging three thousand hours in the F-16 – the equivalent of flying nine-to-five every day for a year. Today, F-16s make up roughly 15 per cent of the total aircraft in the world's air forces. For foreign pilots, Tucson is where it begins.

Tucson is where Nawaf was one night in late June, sitting in his one-bedroom apartment watching TV when the phone rang. "You okay?"

It was one of his American friends. Nawaf said he was fine, thinking his friend was asking about the weight-lifting injury he'd been rehabbing.

No. On the news, his friend said. He'd just seen it. An F-16 had crashed near the Mexican border. Was he okay?

N PHOTOGRAPHS, the F-16's smooth contours, compact shape and sleek gunmetal-grey skin make it appear lightweight and easy to manoeuvre. Even looking at it up close – measuring a modest 15 metres nose to tail, with a 10-metre wingspan – it seems like a delicate thing. It's only once you're in the cockpit, enclosed in that seamless bubble canopy, that you start to feel its complexity. Its ferocity.

The ten-ton empty weight. The three multifunction displays by the pilot's knees that show a variety of data including thermal video from the targeting pods. The cameras that, at altitude on a clear day, can capture action on the ground from 80 km away. The head-up display mounted above the instrument panel that allows the pilot to monitor vitals like airspeed, g-force and bearing without looking down. The single Pratt & Whitney engine delivering over 29 000 pounds of thrust.

From way up high, it's hard to tell when you're going supersonic. The world appears stationary, like a photograph. It's hard to tell you're moving at all. "It's like you're not sitting in a jet," Nawaf says. "It's like you have wings, and you're flying all by yourself." Until you're rolling into an eight-g turn and feel the blood rush from your head as your g-suit bladders inflate. Or swooping down to 150 m, tearing across Tucson pecan orchards and over the highway, the plane's shadow fluttering over speeding cars as if they were parked.

The Iraqis spent many hours in the classroom learning skills as basic and necessary as taking off before they got anywhere near an F-16. Nawaf remembers 12-hour days when he never laid eyes on

a plane. Each classroom lesson was followed by simulator time, then finally real-time exercises with an instructor riding in the backseat of a two-seater D-model F-16. Eventually, the Iraqis began flying solo in the same jets they would take with them back to Iraq. They progressed to dogfighting and air-to-ground tactics, adapting skills they'd learnt on the T-38 to the F-16. They practised strafing runs on shipping containers in the nearby Barry M. Goldwater Range. Ground controllers from the US military talked them onto the targets to simulate the kind of complex scenarios they would encounter back home. They learnt to use laser-guided bombs as large as two thousand pounds. They also practised dropping dumb bombs, the kind you have to aim the old-fashioned way, angling your jet in a dive towards the target, then quickly peeling away at an altitude safe from man-portable surface-to-air missiles – like the ones ISIS claims to have discovered in large numbers on captured military bases.

"We have to be so precise in order to not have collateral damage, not hit civilians," Nawaf says. "When we get back home, it's our own cities that we will bomb."

In 2014, Nawaf and the other pilots had watched the news as ISIS emerged, seemingly out of nowhere, to begin systematically tearing Iraq apart. Rolling into Iraqi towns in Humvees seized from fleeing Iraqi troops, waving their black flags. Capturing civilians, soldiers, policemen and international reporters. The beheadings. That June ISIS claimed its most significant victory yet, seizing Mosul with fifteen hundred men against an Iraqi military force of thirty thousand. From there its fighters pushed into Kurdish territory, their clear objective to overtake Kirkuk, just a hundred or so miles to the southeast. Sulaymaniyah was not far from the advancing ISIS fighters.

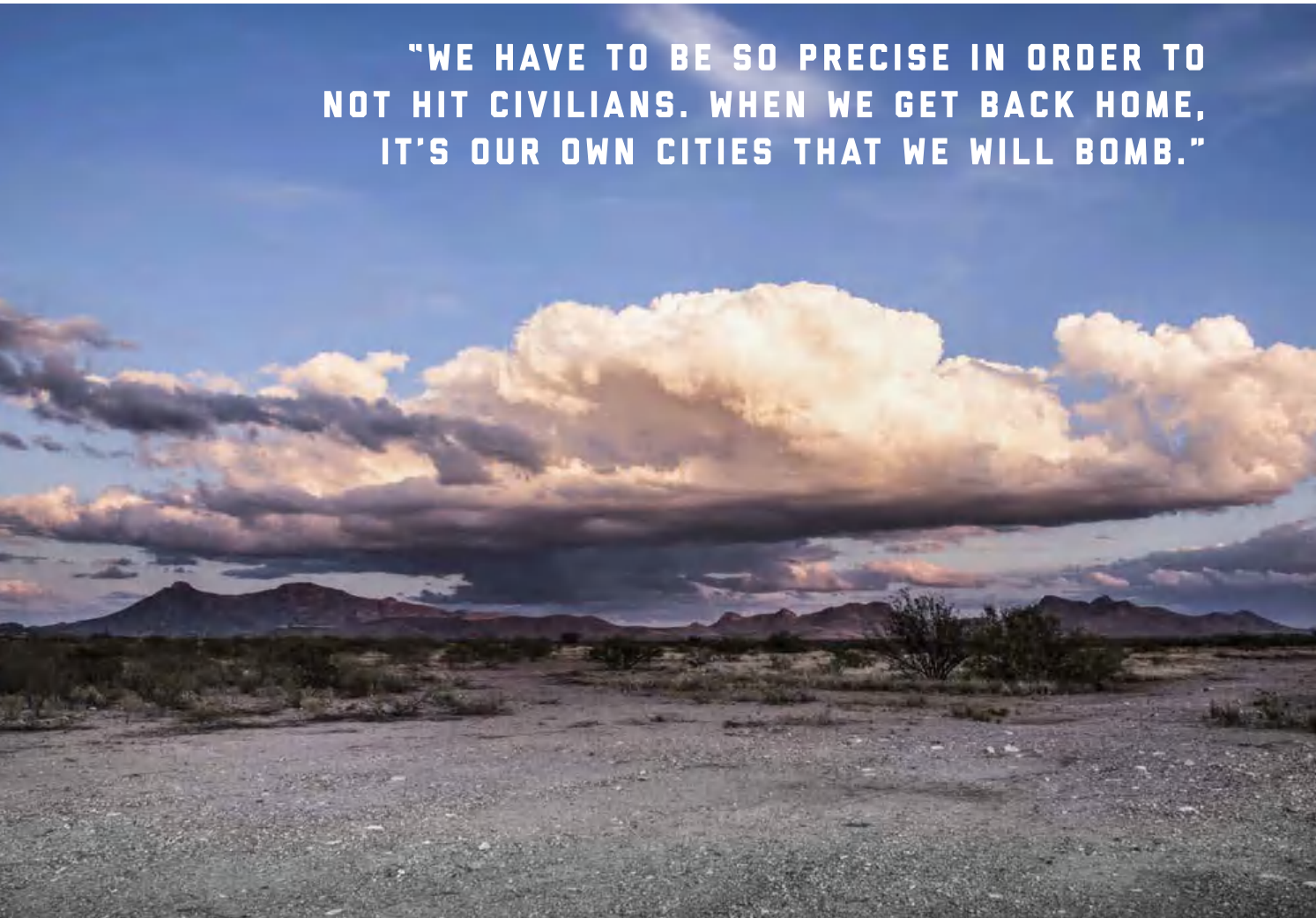
Nawaf spoke to his family on the phone every day and they assured him they were okay. His father, who had once dreamed of being a pilot, wanted only to talk about Nawaf's training, always asking what manoeuvres he'd practised and what kind of targets he had attacked. Still, for Nawaf, thoughts of home were filled with uncertainty.



THE 162ND WING has trained pilots from the Netherlands, Turkey, Israel, Venezuela, Pakistan, Chile, and many other countries. Those trainees are usually in Tucson seven or eight months. Then they return home to train as wingmen with veteran pilots from their own militaries, until they're deemed "mission qualified" – ready to fly

real-life combat missions. The Iraqi pilots couldn't go back home to train with veteran F-16 pilots because there were no veteran F-16 pilots in Iraq. And when the first pilots became mission-ready in 2014, Balad Air Base was not secure. So they stayed in Tucson, rooting for the Spurs, hitting the drive-through at Chickenuuevo Mexican Grill, watching and waiting, staying sharp, flying four days a week.

The instructors offer as much reassurance as they can. "Every one of us has been deployed, whether a mobile training team for three months or an overseas deployment for a year," says Major Shayne Sullivan, 37, an instructor pilot in Nawaf's squadron. "We know how to deal with



"WE HAVE TO BE SO PRECISE IN ORDER TO NOT HIT CIVILIANS. WHEN WE GET BACK HOME, IT'S OUR OWN CITIES THAT WE WILL BOMB."



The site near Douglas, Arizona, where Brigadier General Hasan's plane went down.

being away from family. We can talk through that."

Each day before going up in the air, the instructors talk to the foreign students to determine their mental state. With students from, say, Norway or Japan, these informal check-ins could be as mundane as asking what a student had for breakfast. With the Iraqis, the conversations might be about friends and family killed by gunfire or car bombs. If an instructor thinks a student is too rattled, he'll sit out the flight.

Mostly, though, the Iraqi pilots depend on each other for support. They come from different regions – Baghdad, the Kurdish north, the Sunni Triangle, the Shiite south – but they almost never talk about their sectarian identities. They hang out at each others' apartments making Iraqi food, like a stewed beef dish called pima or the Kurdish okra recipe that Nawaf's mother walked him through over the phone.

"We are Iraqis," Nawaf says. "We are family."

The head of that family was Brigadier General Rasid

Mohammed Sideeq Hasan, call sign "Fitter," the NATO code name for the Soviet-built Su-20 he'd flown as a young pilot. He was a graduate of the Iraqi Air Force academy but only flew for a short time before Desert Storm and all that followed essentially grounded him for two decades. Now, at forty-five, nearly twice as old as the rest of them, he was back in the cockpit. With his black moustache and gold aviator sunglasses and general's stars on his epaulets, he cut the figure of an old-school officer from the Saddam era. But he was known around the base as an unfailingly warm and gentle man. He treated the young Iraqi pilots like nephews. He was the one they turned to when the gruelling training became too much, or when they worried about their families so much it made them sick. Hasan stayed focused. While the others were out revving their V8s on days off – Nawaf in his red 2014 Dodge Challenger, a 392 Hemi with matte black racing stripes down the hood, a radar detector on the windshield, and a tiny pair of traditional Kurdish shoes dangling from the rearview mirror – Hasan would usually be sitting alone in his bare one-bedroom apartment studying, preparing for his role as Iraq's first-ever F-16 squadron commander.

Hasan had been married as long as some of them had been alive and had four kids, his youngest son born just months before he left. Now, the boy was counting numbers on his fingers – counting the days until Hasan’s return. That’s what he told his father when they talked over Skype on Wednesday, 24 June. In just two days, Hasan was booked on a Turkish Airlines flight back to Iraq. The delivery of the first four F-16s had finally been scheduled for mid-July. He was assigned to be one of the first flight leads. He was supposed to be in one of those F-16s that, come September, would bomb ISIS. But there were still a couple last training flights. Later that night he once more climbed the ladder into his plane, streaked down the runway, and shot off into the Arizona sky.

MAWAF HUNG UP WITH HIS FRIEND and called one of the other pilots who lived in his building, and they sped towards the airport. When they got to the base, they saw some of their guys standing outside the Iraqi squadron’s building. They knew it was Hasan from the flight schedule. They stayed at the squadron building until 1 AM. before driving to one of their apartments to wait for more news. The plane had gone down near Douglas, an old mining town of 17 000 residents just shy of the border, about 160 km from the base. Not much there but empty desert and mountains. The Tucson news broadcasts showed a cellphone video shot by a man who lived nearby. The flames were raging, brush fires stoked by the hydrazine in

AN EYEWITNESS SAW THE PLANE BANK LEFT AND THEN ALL OF A SUDDEN TUMBLE OUT OF THE SKY.

the F-16’s emergency power unit, and piles of tyres someone had dumped out in the creosote barrens. About 3:30 AM, the pilots began to drift back to their own apartments. There was still no word about whether Hasan had managed to eject, but they knew how unlikely it was.

Only when the tyres finally stopped smouldering a day later were the hazmat teams able to search for a body. No one knew what had gone wrong. It was a routine night training mission, a two-plane formation with an American pilot on one wing. The pair were headed back north to Tucson. An eyewitness told the newspapers he saw the plane bank left and then just all of a sudden tumble out of the sky.

Brigadier General Hasan was the first Iraqi F-16 pilot to die in training and only the second pilot to die in the 23-year history of the 162nd Wing’s F-16 program. The Air Force is still investigating.

Master Sergeant Jesús Enriquez had the job of cleaning out Hasan’s apartment and packing his belongings for repatriation. Enriquez had bonded with him over the similarities between Arabic and Latino culture. They compared Mexican and Iraqi rice dishes, tortillas and an Iraqi flatbread called samoon. They talked smack about soccer. “He liked the English league,” says Enriquez, a fan of the Spanish league. “We would talk about which was harder, who had better players.” Mostly, they talked about their children. “I’m a father, he’s a father,” says Enriquez. “We talked about how much he missed his children and how fast they’d grown. The first thing out of his mouth was always, ‘How is your family?’ And I do that now – I learnt that from him. Every time I meet somebody I ask them, ‘How are you, and how is your family?’”

Hasan had made little effort to settle into his apartment, so there wasn’t much to pack up. His gold aviators sat on an otherwise empty table. “I always told him, ‘Hey, I like those glasses,’”



← The men of the 162nd Wing (clockwise from left): Colonel Phil Purcell, Lieutenant Colonel Mike Martinez, Major Shayne “Tito” Sullivan, and Master Sergeant Jesús Enriquez.

says Enriquez. "And he would tell me, 'They're older than you.'"



ON 7 JULY, a few weeks after the crash, a Tuesday, a busy workday, about 80 pilots, crew chiefs and base personnel filled the burgundy folding seats of the 162nd Wing's auditorium. Framed photographs of F-16s and MQ-1 Predator drones hung on the walls. The space was

normally used for briefings and promotions. That day it would serve a different purpose. That day it would be the site of a memorial service for Hasan. Enriquez and the Iraqis did their best to make the place worthy of the man. They placed an Iraqi flag beside the US and Arizona State flags. They laid flowers on a table beside the stage. They brought in a large portrait of Hasan, standing with his arms crossed in front of his F-16, wearing his aviators.

Lieutenant Colonel Mike Martinez, a Roman Catholic priest and one of the 162nd's chaplains, opened the memorial with a non-denominational prayer. The Iraqi pilots wrote a eulogy. Martinez and Enriquez had helped them compose it. The words showed on a projector screen as an Iraqi pilot read them in Arabic: "General Hasan was our brother and our leader. By his outstanding example, he gave us strength and inspiration to sacrifice for our country."

"We have lost one of our own and we grieve with his family and countrymen," Colonel Phil Purcell, commander of the Wing, told the airmen in attendance, who represented nine countries. "Every fighter pilot works hard to acquire the skills necessary to employ an F-16, but he did it worlds away from his home, his wife and his children."

Lieutenant Colonel Brant Putnam then followed with a message intended for the Iraqi pilots: "Hasan said that his wish was for Iraqi pilots to be focused and work together in Tucson, so they could fly and fight as one cohesive unit. In so doing, you will become the fighting force your country sent you here to become. And the best part of all is that you will grant General Hasan his wish."

The Iraqis had understood this from the beginning. Nawaf still remembers the speech Hasan had given him when he first showed up in Tucson: "Now that you're here, you have to study harder than ever. You have to fly better than ever." Soon, Hasan constantly reminded the Iraqi pilots, they'd be back home, at the controls of F-16s with the Iraqi flag painted on the tail, dropping ordnance on ISIS.

"He always wanted to make sure that we flew well," says Nawaf. "He wanted us to be good."

The memorial service lasted about 45 minutes, then everyone went back to work. The Iraqis had been given a week off after the crash to mourn but, ultimately, they found the best way of coping was being in the air. "It's total concentration," says Nawaf. "There's a saying that



if you're in the jet and you don't think for a couple of seconds, something's wrong." So they flew.

When they finish – when they are mission qualified – the pilots will leave as they came, in groups of four, in pairs, or alone, adding their firepower to the fight against ISIS one F-16 at a time. Nawaf still has another year. The pilots who have returned to Iraq tell him they're thrilled to be doing their jobs at last. Nawaf can't wait to join them, but he's as nervous about going home as he was to come to the US. Once he's at Balad Air Base, he won't be allowed to leave because of the risk. And he's gotten used to living alone, to the ease of life here, to the freedom of the American highway. He's planning to bring his Challenger back with him.

Hasan's remains were returned to his family draped in an Iraqi flag. In Tucson, his name was engraved by hand on a polished wall of black granite, a memorial commemorating members of the 162nd Wing who have died. Guys named Dale, Willie, Bruce, James, Harry, Jack.

Hasan, Rasid Mohammed Sideeq. It barely fits on one line. But it fits. **PM**

THE CALL OF THE WILD

THERE'S SOMETHING COMPELLING ABOUT THE CALL OF THE GREAT OUTDOORS THAT MAKES US ALL, AT SOME TIME, CONSIDER BECOMING CAMPERS. WHICH OF THESE THREE ARE YOU?

Whether your idea of camping is as simple as just the starry sky over your head or as sophisticated as an all-mod-cons tented camp, the fact is that we can't all afford – or don't want – to have the same experience.

With that in mind, we decided to have some fun matching lifestyles to camping accoutrements, which includes wheels. But hey, if your camping tastes run to champagne while your daily transport is more on the level of beer, nobody's keeping score. Besides, champagne tastes just as good out of plastic glasses.

COMPILED BY KYLE KOCK AND NIKKY OOSTHUIZEN

PHOTOGRAPHS BY KIAN ERIKSEN



THE EMPTY NESTERS

Okay, this profile could also double as the family option, given the relative affordability of this bracket. But empty nesters can opt for the comforts they probably thought twice about, not too long ago.

THE CAR

The **Subaru Outback** speaks to those who could do with the extra space, but have no desire to live with SUV proportions on a daily basis. Of course, its 213 mm ground clearance means that you can venture off the beaten track with a fair amount of confidence. Because of the extra space (up to 1 801 litres) you're able to take that much more along – including the grandkids, from time to time.

It's powered by a 3,6-litre, horizontally opposed six-cylinder motor that churns out 191 kW and 350 N.m of torque. Mounted low and deep into the engine bay, the motor allows for a low centre of gravity. Result: great on- and off-road manners, thanks to the firm's legendary symmetrical all-wheel-drive system. – R544 000

THE TENT

Space, seen by some as a luxury, is regarded as one of the fringe benefits of empty nesting, which is why PM editor Anthony Doman picked the perennially popular **K-Way Vista** four-sleeper as the perfect fit for a couple. It has room for two stretcher beds, undercover storage space, is tall enough to stand in and its two entrances feature mosquito netting. With familiarity, set-up is a breeze – in a pinch, it's a one-person exercise. – R2 000



THE TECH

Many swear by **Bialetti's Moka Pot** (from R400) to redress their caffeine imbalance in style, but the easy and clean **Aeropress** (R700) is gaining support. Campsite coffee cultists who demand the ultimate in freshness will want to add a hand grinder such as the R460 **Hario Mini Mill**.

The **Lil' Bud** emergency light is rechargeable not only via a separate 8-volt solar panel, but also by means of a regular two-prong or car charger. Other features include an FM radio and MP3 player and a mobile phone charging point. Its 30-LED, 170-lumen lamp boasts six hours of run time. – R740

With a **Powerstick** around, nobody should be praying for a mains power outlet. Its 2 600 mAh capacity should be able to top up an iPhone 6S Plus, provided that you bring along the right charger tip. – R250



LOCATION: Imhoff Park, Kommetjie www.imhoff.co.za





THE HIGH-END OVERLANDERS

Ballers, high-rollers: whatever you want to call them, splashing out on luxury items just isn't a problem for these folk. But they also probably don't go too far anyway.

THE CAR

While the previous generation Q7 was Audi's landmark first foray into the SUV segment, the all-new Q7 has improved on the original, and then some. With a more angular design, the Q7 is a styling statement that will endear itself to technophiles.

The 3,0-litre turbodiesel V6 motor under the bonnet provides you with 183 kW and 600 N.m of torque for impressive performance on- and off-road. The Quattro all-wheel-drive system sends up to 70 per cent to the front axle or 85 per cent to the rear, if the conditions require as much. We suspect those pesky sand trails just north of the border shouldn't be too much of a hassle. – R924 000

Popular Mechanics team wasn't able to replicate the manufacturer's claim of erecting the Wizz in 30 seconds, we reckon our five-minute effort is damn impressive. The key lies in its duralumin tube frame, which slides into place inside the structure. – R5 500

THE TECH

The ultimate all-in-one (or maybe for when nobody feels the need to braai), the **Cobb Kitchen-in-a-Box** consists of a frying pan, frying dish, roast rack, chicken stand, dome extension and Cobb cooker – all constructed from durable stainless steel. – R2 670

The **Ecobox 600** is quite a handy device, essentially a solar-powered generator capable of charging a number of different devices through its two 600 W AC outlets, dual USB charging ports and two 12 V DL jack points. Its two LED lights have independent switches and there are two 10 W solar panels. – R12 000

THE TENT

The **Howling Moon Wizz Tent** isn't massive by any means. It will sleep two comfortably with plenty of room for luggage and gadgets. On the plus side, it's really easy to set up. Although the



THE MUSIC FESTIVALGOERS

It's all about getting maximum value for money, but also having as much fun as possible. With mates on a budget in tow, the moola has to stretch as far as possible.

THE CAR

A **Renault Sandero Stepway** perfectly fits the bill for this buyer. One of the most affordable in its class of B-segment crossovers, and armed with a thrifty turbo-petrol three-cylinder motor, the Stepway carries its brand loyalists over a long distance in reasonable comfort and minimal cost at the pumps – with niceties such as front and rear electric windows and air-conditioning – and it sips unleaded fuel at the rate of just 5,4 litres/100 km.

The raised ride height and supple suspension make the occasional gravel road that much more bearable, while the black plastic cladding relegates fear of chipping or scratching the bodywork to the back of your mind – because that's the last thing you want to deal with when you're in the mood to party. – R176 900

THE TENT

The brightly coloured **Starlight 2** tent by **First Ascent** makes so much sense at a festival, because in a sea of makeshift housing for a weekend or more, it's easy to mistake someone else's home for your own. It folds neatly into a cylindrical pack half the length of your typical camping chair. – R1 400

THE TECH

Now what would a music festival be without plenty of chilled beverages to keep spirits high? The **Igloo Quantum 52 QT** boasts a 49-litre capacity and comes with a lockable lid and recessed drain plug. More importantly, it reportedly holds ice for up to five days and with a flat top, and four self-draining cup holders, can be used as a makeshift table as well. – R1 500

Ultra-affordable and portable, the **Ultratec SLS lantern** can be charged via the Sun's rays or its USB port. It's waterproof, just in case. – R 249

PM

*Camping items supplied by Outdoor Warehouse except Vista tent, coffee makers

A BEAUTIFUL THING

FINDING THE BEAUTIFUL OBJECT

concealed in reclaimed wood and turning it to social good is the Milkshed story. This non-profit crafts beautiful hand-made furniture using reclaimed wood and then uses the profits from the sale of these items to make a difference in local communities.

Doing things the traditional way would involve starting with the product itself and matching the material to the product. But Milkshed works the other way around: the wood directs what product it will ultimately become. All the furniture is designed by co-founder Blaire Rieger, who, it's said, has that priceless ability to see the potential in an anonymous hunk of wood. At their East London factory in a refurbished milk shed (of course) fellow co-founder Douglas Grobbelaar leads the carpentry team.

Products are sold via an online shop. "The profits of all sales are channelled into our social initiatives and community projects, which fall under the umbrella of the name Something Good," says third co-founder Cindy Taylor. The projects are varied and range from bringing a bit of sunshine to the lives of the elderly to providing women with much-needed sanitary wear or fixing up schools. They are strict about making sure that they are assisting people in a positive way and not contributing to or creating learned helplessness. "The profits are helpful in fuelling our projects, but they are actually not the focus of what we're trying to do, which is to show people that making a difference is not about donating a wad of money or having to sacrifice all your time. It's about doing what you can, where you are, with what you've got."

Their aim is to create a platform to connect people. Says Taylor: "You might have something in your garage collecting dust that could make a big difference in someone's life. Or you might have a skill that could really help an organisation, but have no idea that the need exists." The take-away: a collection of small efforts can really have a big impact. **PM**

● www.milkshed.co.za

Milkshed woodcraft





COMPANY:

Milkshed

FOUNDERS:

*Blaire Rieger, Douglas Grobbelaar and
Cindy Taylor*

LOCATION:

East London

COMPILED BY LINDSEY SCHUTTERS > lindsey.schutters@ramsaymedia.co.za

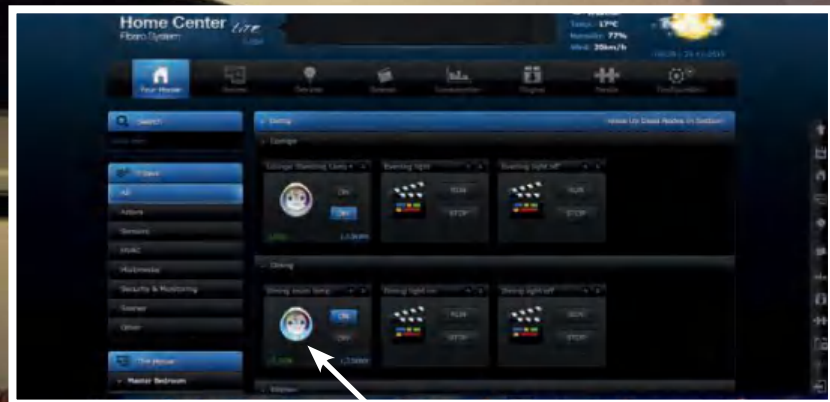


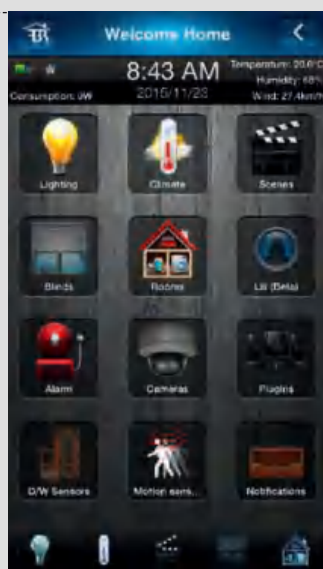
TESTED

MAKE THE CONNECTION

Fibaro home automation Starter Kit

BY ANTHONY DOMAN





Opposite: PC dashboard displays device state and data such as energy consumption – also indicated by plug glowing in a certain colour. Left: The app, as displayed on a smartphone. Above: Graphic display of how energy-efficient two different types of lights have been over the course of roughly eight weeks.

THE RISE OF THE Internet of Things has brought automation to the level of the mass market. Where before you might have been tied in to one-make proprietary systems or frustrated by mix 'n' match set-ups with built-in obsolescence and the risk of dead-end options, now there are modular solutions that offer interoperability, upgradability and DIY capability.

Fibaro sensors use the Z-Wave wireless automation protocol to connect to a central controller, which comes in two flavours: basic or advanced. Both versions can manage essentially the same amount of sensors, but differ greatly in the amount of programming options available – and cost, of course.

The clever thing about these sensors is that they talk not only to the central “brain”, but also to each other, forming a mesh network. Simply, this means that each individual sensor or component constitutes a network smart node that is able to receive as well as relay data.

Fibaro's Starter Kit seemed like a good place to, er, start. Its centrepiece is the Home Centre Lite, packaged with a variety of sensors and clearly aimed at DIY installation.

Now, I should point out that like many others our household has some elements of automation. This includes a remote-controlled driveway gate, alarm system with motion and mag-

netic sensors and timers to switch lighting on and off. The obvious questions were: could the Fibaro system plug into this? Would we need to replace existing equipment? And how easy or difficult is it to set up?

Out of the box, set-up is straightforward for anyone who has fired up a router, hooked up a media player or activated a smart fitness device. After connecting the home centre to our ADSL modem/router using the supplied ethernet cable, I went online to download the Fibaro app. Once logged in, I had a few frustrating moments trying to add sensors to the network, but with a little familiarity this becomes second nature. There's a specific procedure for each type of sensor (click three times on the motion sensor microswitch, for instance). The app will work fine with local access when within range of your home network, but you can go online to *fibaro.com* to register for remote access. To make things easier to see, you could gain access via your PC (no app needed) though the online operation this way can be a little laggy compared with the smartphone app. However, the full-featured PC dashboard does provide analysis and programming tools that make the system so versatile and useful.

As well as built-in device types supported by the system – such as sensors, lights and plugs – there is a “virtual device”

category. This allows the likes of smart TVs and robotic vacuum cleaners to be connected and controlled.

By the way, individual Fibaro sensor devices are wireless in the power sense as well: they are battery-operated. Used with the supplied long-life battery, they should be good for about two years' service.

One immediate element of our current home automation I wanted to change involved switching lights on and off to simulate a human presence while we're away. The electromechanical timers we used worked okay, but constantly needed to be reset after loadshedding. Plus, you could hear them whirring away all the time.

Replacing our old timers with Fibaro plugs made things a whole lot smarter. The Fibaro plug combines a switch, power meter and trigger. It not only retains its time setting even after power outages, but also indicates power consumption in real time by glowing a particular colour, or graphically on the Home Centre interface. All of this data is stored along with backups in the cloud, so you can track and compare your energy consumption.

You can use various things as a trigger for actions such as switching on a device: motion, light level (the motion sensor doubles as a light sensor) or door switch, for instance. Using time as a trigger, I was able to set

two individual lights to go on and off at specific times (including variable times, such as sunset) on specific days of the week. And I can override that at any time from anywhere in the world with an Internet connection.

You don't need the smartest of phones to run the app, either. At home, an iPhone 5 and old Galaxy Tab do the job just fine.

Events can be quite complex, even using the Lite's standard graphical flow-chart event creation system. However, it does not allow comprehensive programming using Lua code; for that you will need the more powerful Home Centre 2.

Now that I was on a roll, I hooked up the smoke detector (doubles as a thermometer) to the system and screwed it to the kitchen ceiling. The motion sensor in the lobby outside the bathroom will be linked to a future alarm system, but in the meantime its primary purpose is to switch on lighting automatically when one of us stumbles out of bed in the wee hours. A camera is in the process of being installed and our intercom needs to be linked, too. Our sunroom awning should really be motorised to avoid having to use the air-con so often. And in these water-restricted times, what about activating a sprinkler system more precisely according to the weather report...?

THE FINDINGS

The Fibaro Starter Kit provides a decent entry to the world of smart home automation at a fair price. That said, I would prefer to have at least one more plug and to do away with the flood sensor. On the whole it is practical, expandable, manageable for the DIYer and offers a surprising degree of functionality.

JUST THE FACTS:

IN THE BOX: Home Centre Lite, flood sensor, smoke sensor, motion/light sensor, smart socket, door/window sensor

PRICE: R8 000, urbantek.com

LENOVO YOGA 3 PRO

Convertible king

FULL DISCLOSURE: I love convertible Windows laptops. I've even calculated a 40:60 ratio of usefulness of touchscreen and trackpad. It takes me at least a day to adjust to a Windows machine that doesn't have a touchscreen and I'm baffled by Apple's insistence to not adopt the tech in the Macbook. That said, most convertible Windows laptops are crap.

A great screen and touch experience come at a heavy cost, so the technology doesn't have a chance to trickle down to cheaper units and thus haven't entered a true mass market. But if you're willing to cough up over

R15 000 for a relatively well-specced laptop with a great screen that can tilt through 180 degrees and offers good touch response, this is the machine you get.

Unfortunately, the test unit was still rocking

Windows 8.1 so I couldn't sample it under the load of the new operating system, but the Intel Core M, 256GB SSD and 8GB RAM configuration kept everything running smoothly and, because of the processor's fanless design, quietly. There is no optical drive in sight, but at least there's an SD card reader alongside the two USB 3.0 and HDMI ports. The other port worth mentioning is a USB type-A-looking thing that Lenovo uses for the power cable. It's a shame that the company abandoned the reversible power cable for this sometimes USB 2.0 monstrosity, but *c'est la vie*.

Notable improvements over last year's Yoga 2 Pro are the new watchstrap-inspired hinge and a better texture on the keyboard. In all the Yoga Pro is in its third succession of 2-in-1 laptop market dominance and long may it reign, but hopefully with a battery that can last 10 hours next year (only managed five on the trot with this model – not great).

Actually, the next iteration has already broken cover in the form of the Yoga 900 and it addresses all of the problems from this model, bumping up performance to Intel's latest Skylake silicon and in line with the Microsoft Surface Pro 4.



JUST THE FACTS:

SCREEN: 13,3-inch 3 200 x 1 800 touchscreen

PROCESSOR: Intel Core M-70

RAM: 8 GB

WEIGHT: 1,19 kg

CONNECTIVITY: Bluetooth 4.0, Wi-Fi, LAN (via USB adaptor), HDMI

PRICE: From R20 000, shop.lenovo.com





LG G4 STYLUS

Competent competitor

LG FOUND ITS FEET with the G4 and has gone to lengths to capitalise on that phone's relative success. One of those lengths is to rebrand the G Pro Lite as stylus-toting versions of the company's flagship phones. Yes, I'm saying that this G4 Stylus and the preceding G3 Stylus are rejigs of the budget-champion LG G Pro Lite.

The recipe of low-end chipset, mediocre camera, big battery and capacitive stylus has produced enough winning results to warrant an annual iterative update. It's not a bad thing, but I expected LG to take more pride in the G Pro lineage. That said, you get an excellent device for your R4 000 and although the model does lose the manual camera controls and leather cladding of its G4 siblings, LG put an extra battery in the retail package to make up for it. On the performance front it's an adequate experience. Android 5.0 works well, but there is a noted lag as the sparse hardware lugs around LG's "enhancements" and graphics, but you'll only notice if you cycle through many flagship phones or are stepping down from a more powerful device.

I used this as my primary device for a work trip and was only tripped up once when hurriedly trying to access my boarding pass in the phone's gallery. With a little foresight and patience G4 Stylus is a great business companion with its large screen and ergonomic build. Stylus integration is nowhere near as good as what Samsung is doing with the class-defining Note series, but that's been the tale with every major manufacturer trying to topple the giant.

The difference being Samsung uses a Wacom-style screen digitiser that plots the position of the stylus on the screen and then uses the stylus to sense the pressure applied, whereas a standard rubber tip stylus is just like a thin finger. Apple is on the right track with the Pencil on the iPad Pro and hopefully that gets ported to the Plus variety of iPhones soon. So yes, you may never use the stylus on this phone, but that's okay because the rest of the device delivers enough to compensate.

The rear camera has an 8 MP sensor and is functional, while the selfie cam is a practical 5MP unit. It looks expensive and delivers an all-round pleasing experience and should definitely be considered if you want a good big screen phone on the cheap, just don't expect to install too many apps on the 8GB of internal memory. And definitely invest in a micro SD card.

PM

JUST THE FACTS:

SCREEN: 5,7-inch 1 280 x 720 IPS LCD

RAM: 1 GB

OPERATING SYSTEM: Android 5.0

CAMERAS: 8 MP main camera with flash and laser auto focus, 5 MP front camera

CONNECTIVITY: NFC, Bluetooth 4.1, Wi-Fi

PRICE: R4 000, lg.com/za



Entangled universe

MIGHT WEIRD CONNECTIONS THROUGH
SPACE-TIME BE THE WARP AND WEFT OF REALITY?
ANIL ANANTHASWAMY PULLS AT THE THREADS

T WAS A CRYPTIC EMAIL THAT JUAN MALDACENA PINGED across

the US to fellow physicist Leonard Susskind back in 2013. At its heart lay a single equation:

" $ER = EPR$ ". The message clicked with its recipient. "I instantly knew what he was getting at," says Susskind. "We both got quite excited."

Excited, because that one equation promises to forge a connection between two very different bits of physics first investigated by Albert Einstein almost 80 years ago. Excited, because it could help resolve paradoxes swirling around those most befuddling of cosmic objects, black holes, and perhaps provide a route to a unified theory of physics. Excited, because it might even answer one of the most fundamental questions of all: what is reality made of?

The origins of the story lie a century ago. In November 1915, Einstein presented the final form of his revolutionary theory of gravity to the Prussian Academy of Sciences in Berlin. The general theory of relativity overturned notions of gravity that stretched back as far as Isaac Newton's day. It said that everything that happens in the cosmos at large – be it an apple falling from a tree on Earth or the distant whirling of a cluster of galaxies – happens because stuff follows invisible contortions in space and time that are caused by the presence of other stuff. Gravity follows from the geometry of a warped space-time.

In the past century, general relativity has never failed an experimental test. Yet the suspicion has grown that it is

missing something. The theory describes space-time as a malleable yet smooth and featureless backdrop to reality. Problems start when a great agglomeration of matter folds this cosmic fabric so tightly that a black hole singularity arises – an object with a gravitational pull so great that nothing can escape.

Black holes are a prediction from the earliest days of general relativity. But in the 1970s, physicists Jacob Bekenstein and Stephen Hawking derived a strange result about them: black holes have a temperature, and hence a property called entropy. This takes us into the realms of quantum theory where everything, be it forces or matter, comes in discrete chunks. Entropy measures how many ways you can organise a system's various con-

stituents – the arrangement of atoms in a gas, for example. The greater the number of possible configurations, the higher the entropy.

Hole in the theory

But if a black hole is just an extreme scrunching of smooth space-time, it should have no substructure, and thus no entropy. For Susskind, of Stanford University in California, this contradiction points to a hole in Einstein's theory. "We know that general relativity is incomplete," he says. "Its inability to account for the entropy of black holes is probably the most obvious incompleteness of the theory."

That's a turnup for the books. In his lifetime, Einstein levelled a similar charge at quantum theory. In May 1935, the *New York Times* ran a story with the headline "Einstein Attacks Quantum Theory", reporting on a paper Einstein had written with Boris Podolsky and Nathan Rosen. It brought to light a weird property of the quantum world in which two particles could instantly influence each other, even if they were at opposite ends of the universe. In Einstein's view, this "spooky action at a distance" – quantum entanglement, as it became known – was preposterous. It was a clear sign there was something missing from the quantum description of reality.

But quantum theory has breezed through even more precise experimental tests than those devised for general relativity. And it is the very property that Einstein discovered – entanglement – that continues to expose the contradictions between the two theories. Allowing quantum entanglement and general relativity to cohabit in the contorted space-time around black holes yields unpleasant and unsustainable consequences. For example, information seems to be destroyed – an impossibility according to quantum physics – or the black hole becomes surrounded by a blazing "fire-wall" of energetic particles (see "Paradox regained").

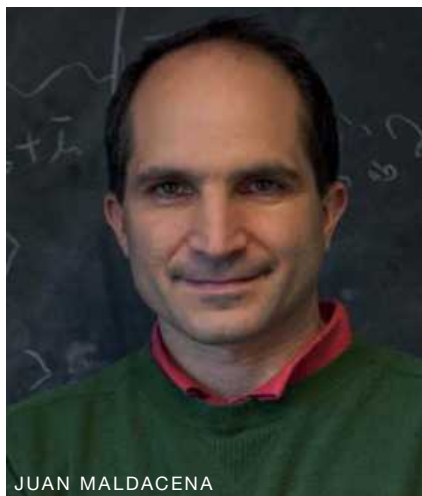
So we need some way to square the two schools of thought – to quantise space-time and form a quantum theory of gravity. Susskind and Maldacena, who works at the Institute of Advanced Studies in Princeton, have long been leading lights in perhaps the most promising field with this aim: string theory. It replaces the point-like particles of current quantum theories with wiggling strings of infinitesimal size, and suggests space-time has a grainy substructure: you can't keep chopping it indefinitely into smaller and smaller pieces.

PARADOX LOST: THE BLACK HOLE SOLUTION

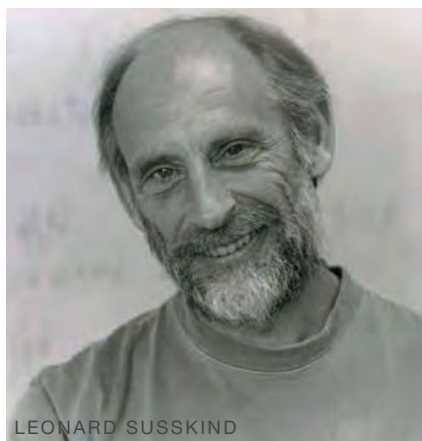
The main problem with the black hole paradox is the idea of quantum monogamy – a particle can only be entangled with one other particle at a time (see "Paradox regained"). This means that three quantum systems – say a particle inside a black hole's event horizon, a particle outside it, and a third far, far away – can't all be entangled at the same time.

But physicists Juan Maldacena and Leonard Susskind argue that this can be resolved if the particles just inside the horizon and the particles far away are connected via a wormhole. When a wormhole connects two objects, one must lie to the future of the other.

So, although these two particles might be entangled, their entanglement doesn't necessarily conflict with the entanglement of the particle inside the horizon and its immediate partner outside the horizon – because they aren't all happening at the same time. Uncomfortable apparitions such as blazing firewalls at the event horizon disappear. Paradox removed.



JUAN MALDACENA



LEONARD SUSSKIND

WORMHOLES R US

What if empty space is full of holes, and all the world is made of information? That's the implication of the latest promising route to a "theory of everything".

But if string theory does hold the answer, it's well hidden. The theory has more than 10 500 solutions, each describing a different sort of universe – making it nigh-on impossible to find the one solution that corresponds to the geometrically flat, expanding space-time filled with the exact complement of fundamental particles we observe around us.

A startling insight from Maldacena in 1997 gave new hope. He conjectured that string theory equations describing gravity in some volume of space-time were just the same as a set of quantum equations describing the surface of that volume. If you could solve the surface equations, you could get a viable theory describing gravity inside.

This "Maldacena duality" was a bold leap – but physicists found that it held. "The funny thing was that it was not proven, and it was difficult to even understand why this was happening," says theorist Mark van Raamsdonk of the University of British Columbia in Vancouver, Canada. "It was very mysterious."

In 2001, Maldacena himself provided an intriguing example, going back to a paper written by – you guessed it – Einstein, again with Rosen, and again in 1935. This one exposed another peculiarity of black holes. It showed how something that looked like two separate black holes from the outside might be connected on the inside. This interior connection formed a shortcut through space-time, and came to be known as an Einstein-Rosen bridge – or in common parlance, a wormhole.

Quantum chewing gum

The really odd thing, though, was that Maldacena's duality showed that such a

Holidays are fun, but...

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wormhole would only form if the out-sides of the black holes were quantum-entangled.

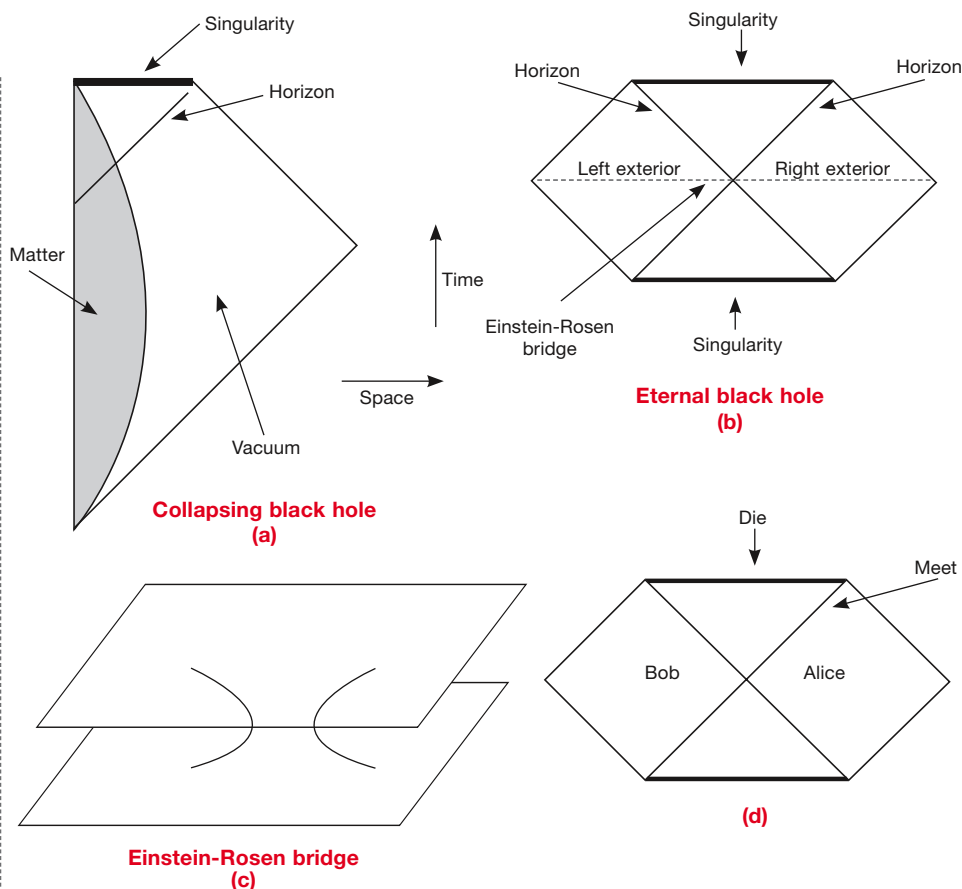
By 2009, the underlying mathematics was sufficiently well developed for Van Raamsdonk to explore further. Entanglement is not an on/off thing – it can exist in varying degrees. So what would happen if you were to slowly reduce the amount of entanglement between the black holes' surfaces to nothing? The answer was rather like pulling at two ends of a piece of chewing gum. "The two sides get further apart, and what's connecting them is this really thin piece of gum, and eventually it snaps," he says. The wormhole becomes thinner until it breaks, and you have two unconnected bits of space-time. Reverse the process – increase the entanglement – and the wormhole starts to form again.

It took a few more years for the penny to finally drop in Maldacena's mind, and for him to make the suggestion laid out in that excited email. ER = EPR. ER – the paper Einstein wrote with Rosen in 1935 introducing the concept of wormholes. EPR – the paper he wrote with Podolsky and Rosen the same year introducing the concept of entanglement. What if, asked Maldacena, wormholes and entanglement are in fact two sides of the same coin: the same physics in two different guises?

The immediate attraction was that the principle seemed to get rid of those pesky paradoxes involving firewalls around black holes (see "Paradox lost"). But it also provided some form of explanation for the phenomenon Van Raamsdonk's work had exposed, in which space-time in the form of wormholes could be created and destroyed simply by tweaking the amount of entanglement.

"It's pointing to a statement that is really quite dramatic," says Van Raamsdonk. "Space-time is really just some geometrical manifestation of entanglement." Maldacena comes to the same conclusion. "There is a very close connection between quantum mechanics and space-time," he says. "The continuity of space-time, which seems to be something very solid, could come from the ghostly properties of entanglement." Susskind speculates further. Quantum entanglement is a form of information, and so "space-time is a manifestation of quantum information", he says.

Heady stuff. But does that really mean that when quantum entanglement exists between two particles – as can easily be made to happen, say between photons in a lab experiment – they are connected by a microscopic wormhole? Or that we live on a backdrop that is nothing more than



A: This spacetime diagram representing a collapsing black hole shows only the time and radial directions. At each point in the diagrams, there is also a sphere. Lines at 45 degrees represent the direction of propagation of light signals. The shaded region contains the collapsing matter. The thick line is the "singularity". Black holes that are actually formed in our universe are represented by such spacetimes. **B:** The full eternal black hole has two asymptotically flat regions, one to the left and one to the right. Each of these regions looks like the outside of a black hole. The Einstein-Rosen bridge is the spatial section of the geometry that connects the two sides at a special moment in time. **C:** The spatial geometry of the Einstein-Rosen bridge. **D:** Bob and Alice jump into their respective black holes and meet in the interior.

the 1s and 0s of entangled information?

The short answer is: we don't know. One very big caveat is that all of the work linking entanglement with space-time so far has been done with a space-time that isn't expanding. Van Raamsdonk and others are working to extend the results to the sort of expanding, accelerating space-time that makes our cosmos.

But for those involved, this is the most positive lead yet towards a theory of quantum gravity that can unify the forces of nature. The ER = EPR principle is something "that a theory of quantum gravity should obey", says Maldacena. Susskind thinks so, too. "We are sure that these things are going to be part of the final story," he says. "But I don't think we have a clear picture of what that final story is yet."

Others are less convinced. Joe Polchinski and Don Marolf are physicists at the University of California, Santa Barbara, and part of the team that exposed the black hole firewall paradox.

Polchinski is concerned that the ER = EPR idea will end up modifying a central principle of quantum theory, known as superposition. Exemplified by Schrödinger's cat, this principle explains that a quantum system can exist in two different states at the same time. When quantum objects become entangled, they also enter a superposition.

At first glance, the ER = EPR hypothesis would mean quantum systems that become entangled, and therefore enter a superposition, suddenly gain a wormhole – a conjuring trick the superposition principle doesn't obviously allow. That's problematic, says Polchinski. "Quantum mechanics is weird, but it works," he says. "When you give up superposition, it's just weird."

Still, he remains open to the eventuality. "In the history of science, things that seemed absolute in many important cases have turned out to be not absolute," he says – Newton's law of gravitation, for example. "Maybe superposition is one of

them.” Maldacena says that it’s too early to say if their work is threatening the superposition principle, because the mathematics hasn’t been worked out in detail.

Marolf for his part isn’t convinced the ER = EPR equality works in all circumstances: Susskind and Maldacena have shown how to avoid the firewall only for a particular entangled state of black holes. “You might think that it shows how to get out of the [firewall] paradox for any highly entangled state, but that’s not true,” says Marolf.

Given that Einstein developed the ideas of both wormholes and entanglement, one can only wonder what he would have made of it all. “My guess is that the old Einstein would have said poppycock,” says Susskind – after all, Einstein spent much of his later years arguing for a hidden reality that wasn’t subject to the vagaries of quantum mechanics. “But the young Einstein apparently had a much more flexible mind. My guess [is] that the young Einstein would have embraced these ideas, loved them.”

■ *Anil Ananthaswamy is a consultant for New Scientist.*

PARADOX REGAINED: THE BLACK HOLE PROBLEM

In the 1970s, Stephen Hawking showed that black holes emit radiation. The mechanism has to do with quantum mechanics, which allows pairs of quantum-entangled particles to spontaneously pop into existence. When this happens near a black hole’s event horizon, one particle may travel outwards, while the other goes towards the black hole. The result is a steady stream of outgoing particles, called Hawking radiation.

If no new matter falls into the black hole, this emission means the black hole will eventually evaporate. But matter is information, and in quantum theory information is sacrosanct: it can never be destroyed. So if a black hole evaporates, what happens to the matter, and therefore information, that fell into it?

One possible solution to this “black hole information loss paradox” is the idea that information escapes with the Hawking radiation. But in 2012, Joseph Polchinski and Don Marolf of

the University of California, Santa Barbara, and colleagues showed this option creates other problems. General relativity demands that the space-time around a black hole’s horizon should be smooth and featureless. It turns out that for this to be the case and for information not to be lost, a Hawking particle on its way in would have to be entangled with all other Hawking particles that left the black hole at all earlier times, rather than just its partner outside the horizon.

This offends a fundamental quantum rule known as “monogamy of entanglement” – that a quantum particle can only ever be fully entangled with one particle at a time. But if you break the polyamorous entanglement of Hawking particles, an energetic “firewall” of radiation forms at the event horizon. That, unfortunately, goes against the tenets of general relativity. Paradox preserved.

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DRONES

They're everywhere. Crashing into the seats at the US Open. Crashing on the White House lawn. Drones may be getting more and more popular, but what can you really do with them? Does a normal person actually benefit from them? I decided to find out.

BY NEAL POLLACK





HEY SENT ME DRONES. Integrate them into my daily life, they said. It was going to be a challenge. My daily life tends towards the mundane.

"Can they fold laundry?" my wife asked. "Can they do dishes? Can they cook dinner? Can they drive carpool? Will they mow the lawn? Or vacuum? Or sweep out the garage?"

My wife and I share these duties. Neither of us likes any of them, except the cooking, sometimes, which we weren't about to turn over to a remote-control flying machine.

"Probably not," I said.

"Then what good are they?"

It was the million-dollar question. And not just for us, but for everyone. Da-Jiang Innovations (DJI), the world's largest personal drone-maker, is expected to hit a billion dollars in sales for 2015, double 2014 and four times its 2013 sales. The company's largest market is the United States. Owning a drone is becoming as American a right as owning a gun; Congress has forbidden the Federal Aviation Administration from limiting hobbyist drone use, even if that means, as happened last year, those hobbyists occasionally fly their drones into the White House.

So drones are everywhere, but unless you make a living filming awesome surfing footage, their uses aren't exactly clear. I thought I could have one fly into the kitchen and fetch me a beer. But someone would have to open the fridge and place the beer on the drone. Someone else, probably me, would have to make sure that the drone flew the correct path back to me without dropping the beer. That seemed pretty inconvenient and difficult.

Domestic considerations were out. Drones weren't going to help me work, unless one of them was a sentient typing drone. So I turned my thoughts towards leisure pursuits. Drones couldn't help my pub-trivia team. I briefly considered taking the drones to play Frisbee golf with me. They could carry my bag. But the ones I had can't lift more than a kilogram safely. Also, I don't play Frisbee golf.

My cleverest idea involved having a drone wait in my stead at a trendy restaurant, where there's always a line. I could put a "Pollack + 1" sign in its talons and take photos of the hipsters watching the drone, whether they were amused, annoyed, or both. But even then I'd have to be nearby, making sure the drone hovered and moved forward. Also, even the sturdiest drone battery eats through its charge in twenty-five minutes. You can barely get seated at a KFC in eKasi in that amount of time.

There was only one option left, what's more or less my favourite thing anyway: screwing around.

On a Sunday afternoon, my friend Jennings came over with his sons, who are fourteen and ten. Joined by my son, thirteen, we began with the Rolling Spider Mini Drone from a French company called Parrot. It came out of the box angry-looking and ready to party, the size of a small rodent. We easily snapped it together, attaching a flexible plastic axle with two large rubber wheels on



The author operating DJI's Phantom 3, his favourite drone.

either end to the top to form a sort of protective cage. Parrot recommended this for indoor use. We also gave it an ironic handlebar-mustache sticker, one of many that came in the box.

Parrot drones are operated via a free app called FreeFlight 3, which the Spider connects to via Bluetooth. All you have to do is pair your device and then you can operate the drone. We chose my son's iPad because it had the largest screen. The app was fairly intuitive. At first, I pressed Take Off. The Spider whirred to life, lifted off the ground and hovered a few feet in the air, like a vicious, wheeled, red hell-bee. Buttons on the screen allowed the drone to shift directions and angle up or down, but motion also controlled it. I tilted the iPad. The drone gave a little wheeze, lurched forward, and slammed headfirst into my office door. It was a start.

The app made sense, as long as you remembered to keep your finger on the correct on-screen "button," which helped glide the drone left or right. A left button rotated the drone. They were easy to get confused at first and also every time I flew the drone.

We got the Spider down the passage to the kitchen and cheered when it flew through the buffet opening into the dining room. Everything was going great. Suddenly, the drone's green eyes turned red. It dropped to the ground and started turning around madly in a circle, making crazy whirring sounds.

I rushed into the room to find the Spider running up and down my wife's leg, like a horny puppy, only with chopping blades. The Spider holds a charge for only six minutes or so, though it apparently doesn't die instantly,



going through a dementia phase that's painful for everyone to experience.

Next, we went outside to try another Parrot drone, the Bebop, which is larger and comes with a built-in camera – but is just as intuitive and easy to use, as drones go. By this point my son had gotten bored with drone life and kept his iPad indoors, so we used Jennings's Android phone, the next-biggest screen available to us.

The Bebop worked slightly differently than did the Spider. Because of the camera, you saw the street view on the app. Jennings's older son, Eamon, figured out pretty quickly that the best way to fly the Bebop was to look at the screen. If you tried to look at the drone while manipulating the screen controls, it would be disastrous. Needless to say, we flew it into every tree on the block.

But eventually we figured the drone out and even landed it safely a couple of times. The Bebop whizzed up and down the street merrily until Jennings lost control of it and thunked it onto a roof across the street. It sat on a slope pretty near the edge and would be easy to get.

I rang the doorbell. A couple of minutes passed. An elderly lady hobbled to the door. It was nearly 4 PM on a Sunday, so perhaps I'd woken her.

"Yes?" she said.

"I'm your neighbour," I said through the door, which she clearly wasn't about to open. "I flew a drone onto your roof and I have to get it off. It won't take long."

Ten seconds passed. Finally, in the most reluctant tone possible, she said, "Okay." She clearly regretted having lived long enough to see the drone era come to pass.

Along with the Parrot drones, I got a box from a com-

pany called Axis Drones. It contained four tiny drones, each about the size of a Marie Biscuit and just as tempting. Two were prototypes, but the others, the Axis Nano Drone for Beginners and the Axis Turbo-X Drone – "The World's Fastest Nano Quadcopter" – are available now. These little drones operate on a six-axis stability system that allows them to do complicated flips with perfect balance. All you need are two AAA batteries and a USB charging port, and you're set.

The Axis drones operated via a double joystick, like a very complicated Xbox controller. As a friend said, "These are the drones you need to fly first, so you don't end up crashing an expensive model into a TV tower." The left joystick controlled throttle and rotation and the right joystick operated the directional movement. If you pressed the left joystick in, it changed the speed and pressing the right joystick would make the drone do flips. There were also small arrow buttons for "directional compensation."

It was all a lot of fun, though not entirely intuitive. We flew the Axis drones around, mostly outside. They were very fast, like little UFOs. The major drawback was that they needed to be charged every five minutes. Unlike the Parrot drones, which use batteries, these need to be charged via USB. So we flew one around for a few minutes, then charged it quickly while flying the other one around. They got integrated into my daily life by taking over my daily life completely.

When it was finally my turn to fly the Turbo-X drone, it launched and hovered. I flicked the left joystick. The drone flung into the air.

"That's going pretty high," Jennings said. Before I could stop it, the drone was over the rooftops of my neighbourhood. Then it was over the tree line. Panicked, I flicked the joystick, which only flung it further. We lost radio contact. Then we lost the drone. Inside the box, they'd written, in marker, "BE CAREFUL!" Now I knew why.

Jennings and the boys and I spent the next 45 minutes searching the drainage culvert behind my house and the three houses on either side of mine. No luck. I snuck into the backyard of the creepy house two doors down from me, an act that in Texas runs you the risk of a twelve-gauge shell in your face. The Turbo-X had completely vanished. If only we had a drone that could help us find it.

The following weekend, I had to drive down to Houston for an assignment. My friends Dakota and Allison, who used to be in my band, live there now. I brought the Rolling Spider drone, figuring we'd have some fun.

Dakota's life is always taking weird tech turns. I arrived at his house to see that he'd recently acquired a 1980s LexisNexis terminal, which he turns on just so he can see it say that it can't find its network. He also has two old black-and-white Sony TVs with little screens and long backs, which he's hooked up to his com-



NEW FACEBOOK BUTTONS

Recently, Mark Zuckerberg hinted at the possible introduction of a "dislike" button to Facebook. Soon after, the company tested six emoji icons (love, laughter, happiness, surprise, sadness, anger) called "reactions."

This will be an amazing thing. It's great to be able to show your friend "I also don't like that your hamster died," but it's also cathartic to be able to express another sentiment. Namely, "Tina, if you post one more picture of your brunch I'm going to unfriend you."

STUPID ➡ AMAZING



G

• The three vacationing Americans who fought and disarmed a



puter so when he has FaceTime business calls, the people he's talking to "look like Max Headroom". Drones weren't going to scare this guy.

We had a jolly time bashing the Spider drone into walls, but it got old. Then, at dinner, Dakota said, "Allison's parents got me a remote-control shark balloon for my birthday. We could set it up and have the drone battle it. It would make a great video."

Allison didn't look too excited about this idea. "I don't want to explain to my parents why you popped the shark balloon," she said, but then added, with a twinkle in her eye, "We do have other balloons. And a helium tank."

We blew up balloons and drew faces on them with markers. Then we tied them to chairs. Each of us took turns getting "kills" while the others filmed the drone. It was really exciting when we managed to ram the drone into the balloons, and it was even better when we were able to keep it upright when the balloons popped. But the real bonus moments came when we missed. Either the Spider brushed by the balloon with its wheels, leaving the balloon teetering but staggered, or, even better, it missed entirely, and went bouncing off walls, crashing to the floor with maximum drama. We could only do this for six minutes at a time before we had to recharge the batteries and then we had to wait an hour and a half. If the charging time had been less, or if there had been an extra battery and remote charger like with the Bebop, we probably would have flown the Spider all night. It was that much fun.

"I can imagine one of these things following me around the house on wheels, telling me when it was time to call people or take the dog out for a walk," Dakota said. "They should make that drone."

The Spider had passed its audition.

THERE WERE TWO MORE DRONES LEFT. The Ghost Aerial was from a Chinese company called Ehang. It has a pivoted support that is compatible with a GoPro camera. I arranged for shipping with a young woman who had a North Carolina number, though the Ghost came to me from Las Vegas, by way of Hong Kong. The Ghost was a mysterious, unreliable pain in the butt. I later figured out that it's a poorly made knockoff of DJI's Phantom 3, the best drone I tested and the gold standard of the drone world. The Phantom comes with a built-in camera and comprehensible instructions. It's the product that will influence how we think about personal drones going forward. But on the day that my friend Tyler was available, all I had was the Ghost.

It was my biggest and most powerful drone at the time and was the one with the most filming capability. We intended to do something spectacular with it. Tyler, a movie and TV prop master and explosives expert, is a huge pyro. I've spent many delighted hours in his company blowing up pumpkins with fireworks. I told him to prepare a platform, and we'd film some spectacular

explosions. Maybe I should have taken the Ghost out of the box first.

It came with written instructions on how to fly it via an iPhone app and with a list of parts but with no instructions on how to put it together. By degrees, we figured it out. We assembled the camera, but we'd lost some screws, so Tyler had to connect the camera to the bottom using kitchen ties.

"I thought you were coming with a mechanic and a drone pilot," Tyler said, looking a bit annoyed. "I thought we'd be ready to go."

No such luck, buddy. After nearly an hour of frustrated wrangling, we snapped the battery into place. The Ghost hummed to life, with blinking red and blue lights. It was very cool and futuristic-looking, all white and stainless steel. Daylight was running short. We had to get it into the air quickly.

There was a little black box, which turned out to be a Wi-Fi apparatus that could simultaneously communicate with the Ghost and with my phone. But I couldn't find the antenna. I spent fifteen minutes trying to ram a piece of plastic landing gear into the antenna slot. That didn't work. I watched a video on the app, which showed a guy flying with the box under his phone, without the use of an antenna. But when I tried to get the app to connect, it just gave me incomprehensible calibration instructions. Then I looked at the owner's manual, which was also on the app, but it was in Chinese. Tyler, his girlfriend, Mollie, and I, all three relatively competent adults, could not for our lives figure out what to do next. The instructions just weren't clear. I pressed a link on the app called "Binding," and this appeared on the screen:

"Reminder BINDING... After success Then the plane electricity. STOP BINDING Cancel."

This instruction appeared over an area map. Of Guangdong, China. By now it was dark, and it was very clear that we weren't going to get the Ghost into the air. But I wanted to see fireworks.

So we left the drone on their kitchen table and drove a couple kilometres out to Tyler's friend's property. She lives on eight hectares of cow pasture, untroubled by light pollution. The drone would have loved it.

As we walked onto the property, a guy was tossing a jug of kerosene onto a pile of wood as three mastiffs and Mr Magoo, the largest Boston terrier I've ever seen, ran around him in circles, snarling madly. Within seconds, it was a raging bonfire. So we sat out there on the grassland for a while, lighting off fireworks and drinking beer and then lighting off some more fireworks. Tyler had gotten ahold of some good ones. If only the Ghost drone had been able to film them. It would have gotten a real nice look at my daily life.

GENETICALLY MODIFIED BABIES

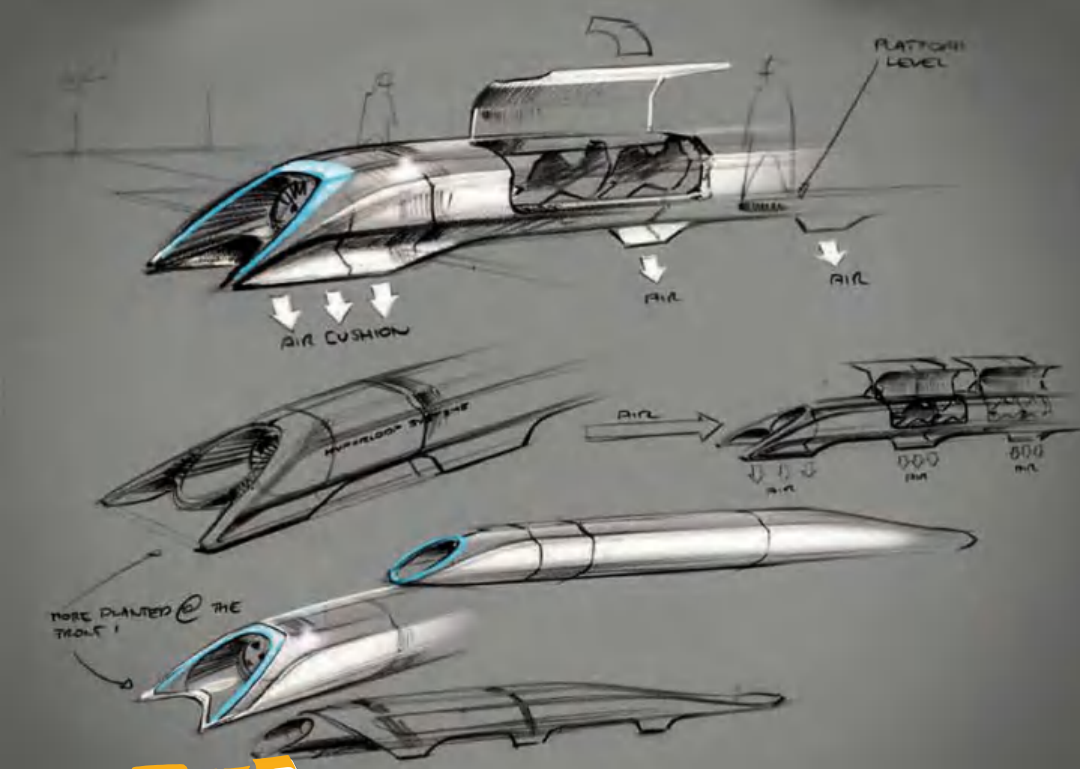
A new gene-manipulation technique called CRISPR uses an immune-system response discovered in bacteria to extract portions of DNA in cells and replace them with a desired combination. While the concept is not new, CRISPR is significantly faster and more cost-effective than previous methods. If we can somehow avoid the impulse to pick our kids' height and hair colour in utero, CRISPR brings us much closer to being able to remove bad mutations, such as the one that causes cystic fibrosis.

STUPID < > AMAZING



STUPID < > AMAZING



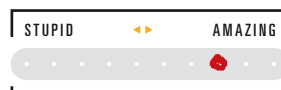


THE HYPERLOOP

it. Hyperloop Transportation Technologies crowdsources its labour, pays in equity, and has more information on its Facebook page than on its home page. The other, Hyperloop Technologies, has venture capital funding, a former president of Cisco for a CEO, and a hip Los Angeles headquarters. We don't know which, if either, will be successful. But that doesn't matter. What's amazing about the Hyperloop is not actually the Hyperloop. It's how we address challenges like it.

The Hyperloop is a staggering proposal – a completely different form of human transportation that would connect cities in ways never before possible. But how will the capsules that riders sit in be slowed for stops and transfers without causing a pileup? Can g-forces be kept within reasonable limits? Will there be bathrooms? How hard will they be to use without peeing on yourself? If crowdsourcing, social media and open-source technology can surmount these challenges and create large-scale physical infrastructure, we'll officially be in the next epoch, one in which the technologies we've spent the past thirty years trying to understand will have finally been harnessed.

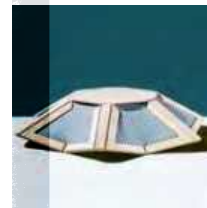
Since 2013, when Elon Musk gave away his rough plans for the Hyperloop – a tube-based transportation system that would travel at nearly the speed of sound – two companies have emerged to develop



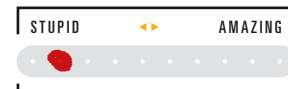
THE SELF-ASSEMBLING TABLE

Think of the ideating, engineering, and innovating that went into the design and technology behind this amazing side table that assembles itself. This furniture – the first time anyone has

thought to create such a thing – was invented at the MIT Self-Assembly Lab. The malleable wood is sandwiched around a synthetic textile and when the flat table is removed from the box, all you do is give it a slight pull and the tension of the fabric causes the wood to snap into place. It must have been a staggering number of man-hours and a huge amount of brainpower from some



incredibly smart individuals. Just imagine if they had spent their efforts creating something the world actually needed.



THE LATEST SPECIAL EFFECTS



FURIOUS 7

After Paul Walker's death during the filming of *Furious 7*, director James Wan had to complete a movie without one of its stars. Using archival footage, Walker's brothers as body doubles, and advanced CGI software, Wan created a seamless stand-in – and a surprisingly touching homage. Twenty years from now, when a new generation watches this movie for the first time, unless it's revealed by the hologram information bubbles that will undoubtedly annotate life by then, no one will even know.

TERMINATOR: GENISYS

When Arnold Schwarzenegger debuted as Terminator, he was in his thirties. No matter how well he aged in the thirty-one years since, it would have been impossible for him to re-create his iconic nude scene for this year's *Terminator: Genisys*. Unfortunately the plot called for it, and audiences were subjected to a video-game-like rendering of young Arnold. In a movie in which computer software threatens humanity and time-travelling machines have German accents, the youthful Schwarzenegger was the hardest part to believe.



McDonald's new all-day breakfast menu. **AMAZING.**



The vapRwear hoodie with a "discreet e-cigarette built-in the drawstring." **STUPID.**



STUPID
OR
AMAZING?



INDUCTIVE CHARGING

The concept has been around since the Palm Pre – a smartphone that charged without cables, simply by being placed on an inductive surface. The Pre never found the success it deserved, but this year, inductive charging finally did. Two main options, Qi (pronounced “chi”) and Powermat, compete for dominance. Their surfaces are sold for home use or incorporated into Ikea furniture and the counters of some Starbucks. Some phones, like the Samsung Galaxy S6, have the technology built in. Others require a special case or patch. But it’s worth it. Set your phone down on a charging pad and listen for a chirp. No dangling cables, no inserting the micro-USB plug upside down, no searching for a wall outlet. Inductive charging is slower than plugging in, but that doesn’t matter. Charging with inductive surfaces becomes so convenient that you can do it all the time. If a coffee shop near you offers tabletop chargers, you can buy a Grande Latte and top off while you sip. Pretty soon we’ll look at these rat’s nests of cables we carry like the anachronism that they truly are.

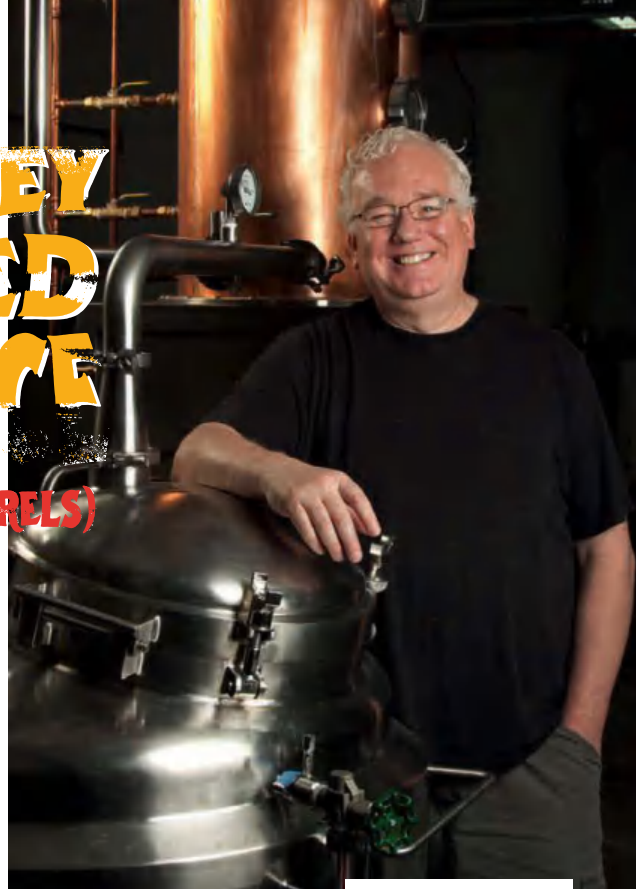
STUPID AMAZING

WHISKEY WOODS SCIENCE

(INSTEAD OF IN BARRELS)

Cleveland Whiskey founder and CEO Tom Lix is not a patient man. He didn’t want to wait the years it takes to age a whiskey naturally – in charred oak barrels as subtle changes in pressure and temperature filter the alcohol through the wood’s pores, slowly absorbing its flavour and colour. So he found a way to age his whiskey in one day.

Cleveland Whiskey is placed in oak barrels, but that’s only to meet the requirements necessary to call it bourbon. From there, the liquor and barrel wood are placed in a vacuum-sealed tank, where rapid pressure changes force the spirit through the wood’s pores. After twenty-four hours, Lix says, his whiskey can compete for complexity with those aged eight to ten years. The process also allows the two-year-old company to play with flavour. In the past, whiskey makers exclusively used oak barrels because they don’t leak. But nei-



Cleveland Whiskey founder Tom Lix at work in the lab.

ther do stainless-steel tanks, which allow Lix to experiment with woods such as black cherry, hickory, or sugar maple to add different dimensions and taste. Cleveland Whiskeys aren’t quite as hearty as more traditional options and have a little more burn on your tongue, but the flavours drawn from the woods do make for an interesting drink. Besides, even if whiskey purists take issue with Lix’s product, it doesn’t matter to him. Lix considers Cleveland Whiskey a technology company, not a distillery.

STUPID AMAZING

PERISCOPE

Were you one of the 4.4 million suckers who paid nearly R1 200 to watch Mayweather-Pacquiao at home? Those no-punching swindlers each banked over R1-billion from record pay-per-view sales.



And it might’ve been more if not for Periscope, the live-streaming video app Twitter acquired earlier in the year. There were 66 confirmed Periscope streams of the fight – sixty-six people broadcasting the action (or lack of) to thousands of Twitter users, free. The streams were far from HD, and they didn’t last long. Twitter worked quickly to shut them down. But their simple existence showed the potential for amateur live streaming to disrupt the out-of-control sporting

event and concert industries. In the first half of 2015, North American concert prices averaged R1 000, an all-time high. Periscope and other live-streaming apps like Meerkat may not be the perfect solution, but they do offer a way for consumers to fight back. Would have been nice if Mayweather or Pacquiao had done the same.

STUPID AMAZING

The Davek Alert, an umbrella with Bluetooth that tells you when you’ve left it behind. **AMAZING** (AND EXPENSIVE).

A *Mary Poppins* remake. **STUPID.**

LIX: PHOTOGRAPH BY BILLY DOLF

THE NEW CAR TECHNOLOGY

POPULAR MECHANICS automotive editor Ezra Dyer on a few things that confounded and delighted him this year.



Hatch sensors

The idea is that you're walking up to your car, arms full of groceries and you deftly sweep a leg beneath the rear bumper, prompting the hatch to magically swing open. When the systems work, they're wonderful. Genius. But what's the worst place to mount a sensor of any kind? Probably right underneath the rear bumper. You can't see it, and every piece of oily crud on the road ends up glomming on in that general vicinity. So maybe you're a little off-target with your leg-wand, or maybe the sensor's covered with a Chappies wrapper. The success rate for these things seems to be about 50 per cent.



Lane-departure warnings

These systems use cameras to read lane markings and determine whether you're straying towards a ditch or oncoming traffic. It's a good idea, but in practise, the constant squawking becomes background noise, just another push notification in the Pac-Man soundtrack of your life.

Lane-keeping systems

Lane keeping takes the warning sounds of lane-departure technology and adds the element of action, teaming the camera with your electric power steering to provide a smooth nudge of the wheel when called for. It's the fixer, saving the day while taking no credit.



Knobless entertainment systems

Perhaps if we all repeat the mantra often enough, it will come to pass: all cars should have one knob for the stereo volume and another to change the station, track or source for whatever streaming ethereal cloud of code constitutes your preferred Bieber delivery system. Basic ergonomic decency aside, the touchscreen aesthetic does not belong in your car. Your phone, your tablet, your TV – you have enough sleek glass interfaces in your life. You need tactility. It's the difference between video poker and laying down a handful of cards on a felt table.

THE APPLE PENCIL

STUPID <--> AMAZING



Roll your eyes all you want. When Apple copies something (tablets, Spotify, smart watches), the result is almost always better than the original. Its new stylus, the Apple Pencil, is no different. It makes sense: The most valuable company on Earth has more resources than a few engineers with a Kickstarter page – the guys making many of the styluses to this point. The difference between Apple and others is obvious if you try doodling with another brand's stylus. Because the stylus is trying to manipulate the screen to think it's a finger, the experience never feels like pen on paper. There's a delay between the movement of the tip across the screen and the mark that follows. Pencil, though, speaks directly to the iPad Pro, which means fast, precision tracking of the angle and pressure applied to the tip. While the usefulness doesn't seem immediately obvious to us (nor did it to Steve Jobs, who famously hated the accessory), Apple's always been good at selling us stuff we didn't know we wanted.



Australian daredevil Robbie Maddison rigs his dirt bike so that he can use it to surf in Tahiti. **FINE, AMAZING.**



ULTRA PANAVISION 70

Quentin Tarantino is famous for breathing new life into things. Blaxploitation. Kung fu. John Travolta. With his new film, *The Hateful Eight*, he'll do the same for Ultra Panavision 70. Most movies you see in theaters, whether they've been shot digitally or on 35 mm film, have an aspect ratio of 1.85:1 or 2.39:1 – wider than the 16:9 of most wide-screen TVs. In the 1960s and 70s, some of cinema's greatest epics – *2001: A Space Odyssey*, *Lawrence of Arabia* – were shot on 70 mm for a 2.20:1 ratio. But because of the high cost, 70 mm narrative features are rare. Since 1992 only three have been shot entirely that way.

Tarantino originally planned to shoot *The Hateful Eight* in 70 mm. A couple of months before production was to start, the film's cinematographer, three-time Oscar winner Robert Richardson, was visiting Panavision's LA headquarters and stumbled across a shelf with some strange museum-piece lenses. This was Ultra Panavision 70, a patented anamorphic lens introduced in 1957 that achieved an astounding aspect ratio of 2.76:1. Only ten films had ever been shot using Ultra Panavision 70 before the lenses were left on that shelf in 1968 – most famously *Ben-Hur*. Naturally, the chariot race was what Panavision screened for Tarantino to sell him on the idea. "We started off with the curtains open to [the width of] a typical movie," says vice president of marketing and technical support Jim Roudebush. "Once we rolled it, we opened the screen all the way out to the very far edges and said, 'This is what you're gonna get.' He was jumping up and down, whooping and hollering." The exact same lenses that shot that scene in *Ben-Hur* were used for *The Hateful Eight*. And, because of the way the glass aged, they look better than ever. "Over time," Roudebush says, "the coatings on the elements alter. The flaws give it character."

Since many theaters lack the technology to screen the 70 mm version of the film, a digital transfer, which Roudebush believes will lose none of its magnificence, opens 8 January. Two weeks before, however, 70-mm prints will be released at fifty select theaters. It's worth the effort to find one. **PM**

Compiled by KYLE KOCK kyle.kock@ramsaymedia.co.za

CARS



AUDI'S AUTONOMOUS CAR

MAN VS DRIVERLESS MACHINE

HOW SMART ARE SO-CALLED SMART CARS, REALLY? EZRA DYER CHALLENGES AUDI'S SELF-DRIVING RS7 TO A TRACK BATTLE TO FIND OUT.

Robby cuts the wheel towards the apex of Turn 1, corrects a moment of understeer, and powers out to the edge of the track with tyres howling. This is a 418-kilowatt machine – an Audi RS7 – on Sonoma Raceway, a fast road course scrawled across the hills of Napa wine country in northern California. We're on our way to something like a two-minute lap time, which is seriously hauling butt. Robby really knows this car. Actually, Robby is the car.

Yeah, there's a guy sitting behind the wheel, Audi engineer Markus Hoffmann. But he's not doing anything except holding a kill switch that he'll deploy if he thinks Robby here is about to go Maximum Overdrive on us and destroy the humans. I'm in the passenger seat. Because Robby

is loaded down with hardware and electronics that allow him to drive himself, the rest of the car is gutted, stripped of a back seat and interior trim in the name of weight savings. Audi wants the car and his two passengers to weigh exactly the same as a stock RS7 with only a driver. You see, we're about to have a contest, *mano a máquina*, and Audi isn't about to handicap its robo race car with extra lard. If I out-drive Robby, it'll be on equal terms.

Among the world's car manufacturers, Audi is one of the most heavily committed to autonomous research. In 2010, a modified version of its TT sports car developed with Stanford University raced up Pikes Peak by itself. Robby's predecessor, Bobby (both were named after the legendary

PHOTOGRAPHS BY ROBERT KERIAN



Unser family of racing fame), drove from San Francisco to Las Vegas earlier this year, 880 kilometres, with the driver just along for the ride. Audi is working on self-parking cars and will soon debut a production system that allows autonomous highway driving in certain situations. But Robby isn't here to prove a car can recognise a stop sign or change lanes to pass a dawdler. Robby is built to demonstrate that Audi's suite of sensors and software is mature enough to take a fast car to its limits on a diabolical road course. And if it can do that, then there's another layer of confidence when you surrender the wheel on your daily commute. You want to know this thing can drive.

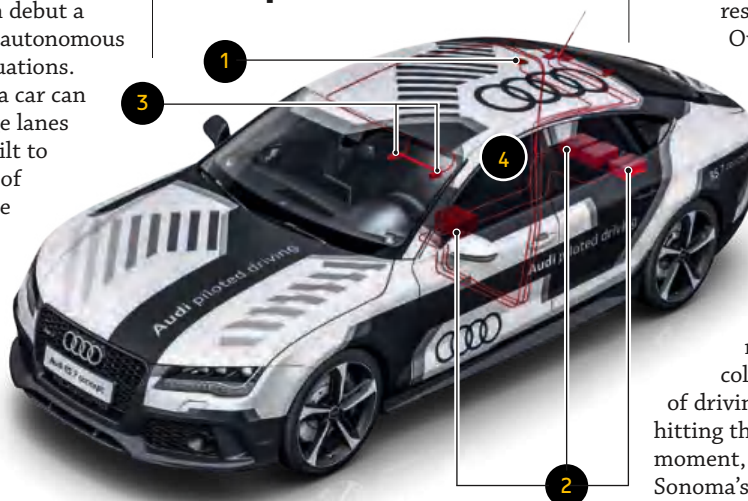
As we make our way around the track, my initial impression is twofold: disbelief that the car is blitzing this track at what feels like 10/10ths, and dismay that I might not be able to match the lap time of this automotive player piano. But as we reach the halfway point of our lap, my sense of sheer sci-fi wonderment gives way to a hint of clinical analysis gleaned from track-day lessons imparted by living, breathing instructors: Robby is fast, but I see how he could be faster.

Where a human driver would try to pick a line and stay on it throughout a corner, the self-steering Audi twitches its wheel with high-frequency corrections, scribbling a sine wave of small inputs. People tend to do that, too, if they're not looking far enough down the track, as short-range focus causes you to drive from point to point instead of thinking about the set-up for that corner 200 metres away. If Robby were human, a driving instructor would tell him to keep his eyes up. Camera up, Robby?

Riding with Robby is my first lap of Sonoma, and I'm just trying to note which way the corners go, never mind figure out the braking points and racing line. Ol' Robby's definitely got an advantage when it comes to experience. First he took a couple of laps and mapped the track with his high-resolution camera, recording the boundaries of the tar all the way around. With that data stashed, he overlaid a plot of an ideal racing line and began turning laps. But since each track is different, the theoretical best line is sometimes at odds with real-world technique – maybe you want to sacrifice speed on one corner to

THE TECHNOLOGY

How Audi's driverless sport sedan works



1. Differential GPS: Relies on a new network of fixed ground-transmitter stations that improve the accuracy of roving satellite receivers. Instead of accuracy measured in metres, we're talking centimetres.

2. Sensor unit, image-processing unit, control unit: the brains of the operation; they process visual and GPS data.

3. Front 3D camera system: the eyes on the road.

4. Driver: or, as Audi refers to the person behind the wheel, "the final redundant system".

set up a blazing exit from the one two turns away. "On his own, Robby can get to about 90 per cent of his potential best time," Hoffmann says. "To get the rest, we program it in." Command: Override late apex. Initiate trail braking. Deploy max throttle.

"What happens if a deer runs out in front of us?" I ask as the tach needle bumps the redline and we sail madly over a blind uphill left-hander. "We'd hit it," Hoffmann says. In the name of speed, Robby isn't running radar, because the nature of radar – judging speed to avoid collisions – is at odds with the goal of driving straight towards a wall and hitting the brakes at the last possible moment, as you do before the hairpin at Sonoma's front straight. Robby is fast, but dumb. Back in the garage, he probably chugs 10W-40 and pays the Stanford TT to do his homework.

When we return to the pits, our lap time is displayed on a whiteboard: 2:02. That's the time to beat, for the honour of humanity. Since I don't know the track, Audi proffers an equaliser: a hotshoe in its R8 supercar will be my lead. I can follow him and try to ape his lines and braking points, if I can keep up.

I try to push it as hard as I can, bearing in mind the peculiarities of the RS7 – its torque-vectoring rear differential means you can get on the throttle earlier than you expect, the rear end forcing the front



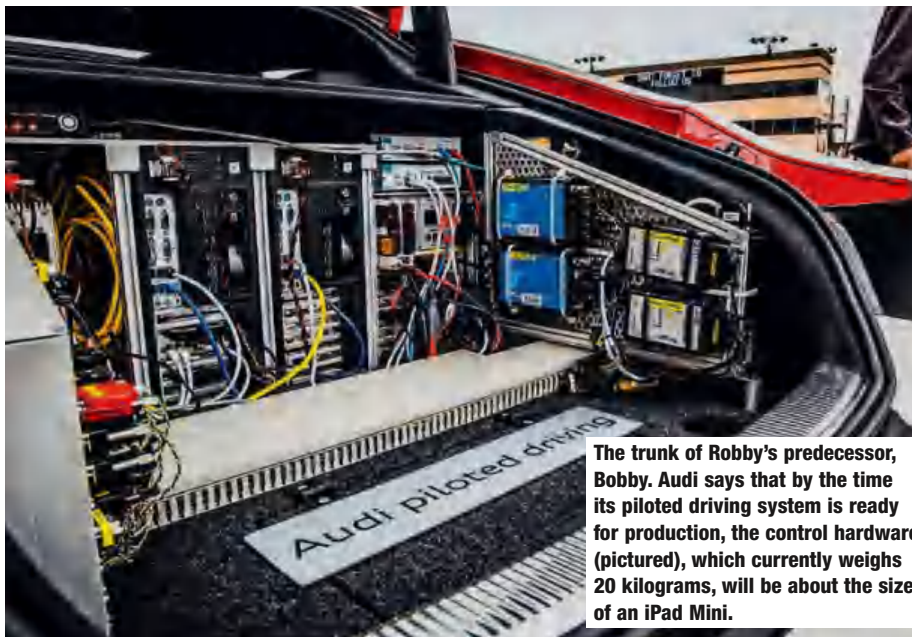


to follow your steering commands. Still, I'm a nervous mess. Racers tell you to drive without emotion, but that's hard to do when the fate of all humankind rests on your lap time. Maybe I'm building this up a little much, but it's hard not to think about this challenge in absolutes: if the robot car is faster, what's the point in screwing around on tracks? Will anyone care about driving skill if it's relegated to the status of long division? I don't need to know how to do long division. I've got a calculator on my phone.

I pull into the pits to see my time on the whiteboard: 1:59. I beat Robby, albeit with an assist from a fellow sentient being. Victory is ours! My inner ear and I have

triumphed over the engineering might of one of the world's biggest car companies. And if a deer had run out, I would've swerved. If only Audi could build a robot as talented as I.

Well, the thing is, they will. Whether it's Robby or the next Unsermobile Version 3.0, they're going to make the steering inputs smoother, the braking zones deeper, the racing line a little closer to the hairy edge of the roadway. The story's not over. Which is underscored as we walk over to the wall at the start-finish line, where Robby's "father", Bobby, sits idling. An unseen engineer pushes a button and the white RS7 roars off for a hot lap. With nobody inside to enjoy it.



The trunk of Robby's predecessor, Bobby. Audi says that by the time its piloted driving system is ready for production, the control hardware (pictured), which currently weighs 20 kilograms, will be about the size of an iPad Mini.

COMING SOON

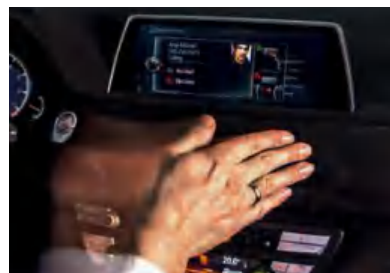
REMOTE-CONTROLLED PARKING



The new 2016 BMW 7 Series has a remote-parking feature intended to help squeeze the car into tight spaces that would otherwise have you climbing out the sunroof. Standing outside the car, you press the forward arrow on the key fob and the 7 Series steers itself into a space. Use the reverse arrow to back it out. Simple, right? Not in the US. There they have a shift-interlock rule that requires the brake pedal to be depressed before you can put a car in gear – difficult to do without a driver in the car. BMW is trying to get some clarity on that regulation, since the rule obviously predates remote-controlled luxury sedans. But they say the system is ready to go as soon as the rules allow.

The key itself offers a hitherto unavailable level of smartness, including a display.

And that's just one of the many features in the seriously tech-rich new flagship from BMW. Due out here in January 2016, it raises the bar in terms of functionality and innovation. Gee-whiz items for the gadget freaks include a rear touch screen infotainment display and Gesture Command. What you can't see is impressive, too: the underlying efficiency of the design is characterised by features such as carbon core and Active Air Stream kidney grille.



EASY CAR UPGRADE

OLD FAITHFUL SOMETIMES JUST NEEDS A GADGET TO MAKE IT GREAT. DON'T SELL JUST YET; INSTEAD, TRY THIS TO ENHANCE YOUR MOTORING EXPERIENCE.

THE CULPRIT:

THE FAMILY'S VENERABLE 1997 JEEP GRAND CHEROKEE 4.0 LAREDO

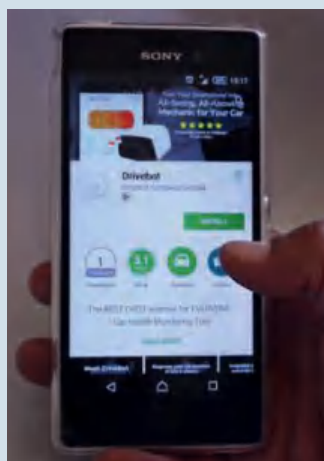


We all know that older vehicles require some maintenance. Sometimes, though, mechanics out there will make it sound like your trusty steed needs more work than is actually required. We all want to know what's really happening under the bonnet and sheetmetal, so we jumped at the chance to use the Drivebot on my dad's Grand Cherokee. Besides the mammoth thirst, we wanted to know what else could be looming.

Step 1: Locate the OBD-II port on your vehicle. The Drivebot is compatible with most vehicles made since 1996, but if you're not sure you can check the list of more than 2 300 vehicles on the website. On the Jeep, the OBD port is dead centre below the fascia panel under the steering column. Other vehicles might have the port closer to the transmission tunnel or somewhere else.

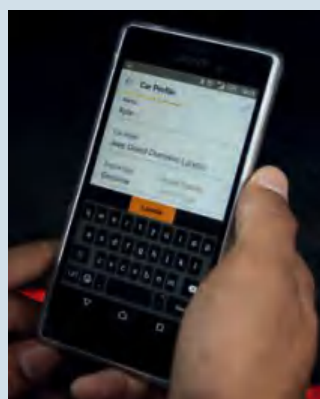
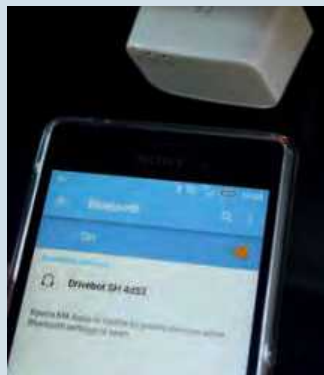


Step 2: After inserting Drivebot and downloading the app – a 10 MB file available for free on Android and iOS devices – switch the vehicle on. With our test unit, after two seconds, the Drivebot's lights flicked on



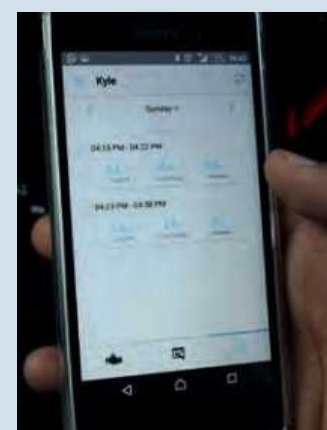
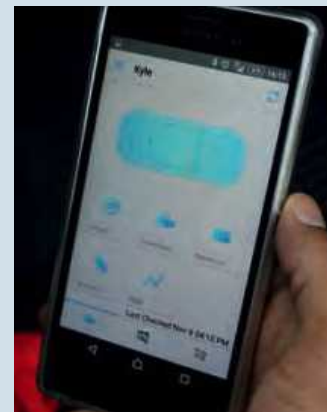
and the device emitted a loud beep to indicate that it was active.

Step 3: Connect to the Drivebot via your smartphone's Bluetooth system. Once paired, the device will ask you to verify yourself as the owner and create a profile with the make and model of your vehicle. With the profile created, you're all set to go.



Step 4: The Drivebot will perform a scan of the vehicle's vital statistics, including the electrical systems, steering and braking, engine and transmission. It will also inform the driver of any issue that might be a concern in the near future. Fortunately, the scan showed that every key area was in top condition on the Jeep.

Step 5: Over and above the diagnosis of your vehicle's current state, the Drivebot also provides a detailed trip log, showing fuel efficiency, fuel used and distance driven – giving you tips along the way about driving style, and which routes will cost you more. It also allows you to set a detailed



schedule of services and parts replacement if you so choose.

On its best trip while testing the Drivebot, the Jeep returned 18 litres/100 km, and with the Drivebot suggesting that everything is in order we'll put it down to the near two-ton mass, permanent all-wheel drive and really old technology in that long-in-the-tooth six-cylinder motor.

Verdict: The possibility that the Drivebot could pick up minor issues before they become major headaches is in itself invaluable. That exorbitant consultation fee at the local repair shop is now a thing of the past.



Want? Order it at www.ktgroup.co.za

The product: Drivebot

Price: R2 496

Claim: Turn your smartphone into an all-seeing, all-knowing mechanic for your car.

HEAVYWEIGHT HOEDOWN

WE'RE CELEBRATING THE YEAR OF THE SUV WITH SOME OF THE BIGGEST ARRIVALS ON THE LOCAL MARKET.

INFINITI QX80

While the rest of the Infiniti range offers varying degrees of desirability and market competitiveness, there's something altogether mesmerising about the heaviest of the bunch – the range-topping QX80.

I mean, just look at it. The mammoth proportions are a lot to take in, easily dwarfing the likes of the Land Cruisers and Discoveries that are so very popular in Mzansi. It's a distinctly American approach that never fails to draw plenty of criticism – and admiration.

The QX80 is powered by a normally aspirated 5,6-litre V8 that could very well do service in NASCAR. The 298 kW and 560 N.m of torque did an impressive job of hustling the three-ton behemoth along the daily route to the office and back. Simple prods of the throttle are met with quite a responsive roar and surge of torque that belies the QX80's mass. The V8's throaty roar is emphasised on downshifts by the rev-matching downshifts from the seven-speed automatic transmission. The downside was the rather impressive thirst – we managed an average of 18 litres/100 km.

As can be expected from the

brand, there's strong standard specification. The only optional extra is metallic paint. True to form, nearly everything's automatic, from the auto-on LED high beam and auto-levelling headlamps to auto tailgate. That includes the Hydraulic Body Control Motion system, with automatic hydraulic chambers that control suspension travel, and automatic mode to the all-wheel-drive system (with 4H and 4L modes), and an automatic rear levelling system.

Occupant comfort has clearly been accorded a high priority: three-zone climate control, 10-way electrically adjustable driver's seat, heated steering wheel and even a heating function for the outer seats on the second row (the front seats boast full climate control).

There are nine cupholders scattered throughout the cabin, and four bottle holders in the door pockets to ensure that nobody in the '80 goes thirsty. If their thirst is more of an existential nature, the infotainment system packs an eight-inch touchscreen and 30 GB Infiniti Hard Drive Navigation System with 10 GB of music storage that plays through a 15-speaker Bose Cabin Surround system. While the dual seven-inch monitors integrated on the rear

of the front head restraints (complete with individual headsets) keep the second row occupied, that main screen up front is vital for moving the QX80 in and out of tight spaces through the around-view monitor.

The QX80 won't suit everyone's taste, but it's not meant for everyone. If you intend to stand out however, this is a sure thing.

Price: R1 238 00, with a five year/ 100 000 km maintenance plan.





MERCEDES-BENZ GLC 250D AND GLE 500

THE THREE-POINTED STAR'S SUV FAMILY JUST GOT BIGGER

GLC 250D

Flying into the middle of Namibia wasn't exactly how I pictured Mercedes-Benz would launch one of its most important introductions to the local industry. Namely, by starting the driving route in the middle of the desert. Then again, after the success that segment has had locally, it seemed about time the Stuttgart-based firm got in on the action. What better way to prove the new vehicles credentials than by throwing it in the deep end?

The deep end, in this case, involved endless dirt roads with some off-roading thrown in for fun, all so we could get better acquainted with Merc's new compact SUV. Behind the wheel of the mid-range 250d, I was immediately impressed with just how ensconced in the cabin I felt. The setting is very familiar and that's because the GLC is based on the company's C-Class. As a result, there's a full suite of comforts on offer, including electric tailgate, automatically releasing parking brake, automatic headlamps and tyre pressure monitoring system.

The 2,2-litre turbodiesel that lies under the bonnet (providing 150 kW and 500 N.m of torque to all four wheels through a nine-speed automatic transmission) was muscular enough to plough through most of the rough terrain that the Namibian countryside could throw at the media contingent. But venturing out on the softest sand has to be done with plenty of caution. The rate of attrition on the Namibian dunes highlighted the fact that this isn't an outright off-roader.

The GLC is most comfortable on the road, as was highlighted when we returned to asphalt. That said, at least it does feature some credible off-road ability.

Price: R619 900

GLE 500

Mercedes-Benz's new naming convention means that it's dropped the ML designation for the model that defined the premium SUV segment nearly 20 years ago. With the third generation Mercedes-Benz has upped the ante on what it now calls the GLE with a mid-cycle facelift.

Visually, there are plenty of styling cues taken from the E-Class, on which the GLE is based. There are revised headlamps with the firm's signature daytime running light styling, while the grille, bonnet and front fenders have also been updated. Along the profile new alloy wheel designs can be found and at the rear, new LED tail lamps can be found just above the bumper.

This particular model is powered by a twin-turbocharged 4,7-litre V8 with a peak power output of 320 kW and a lusty 700 N.m of torque. Through the seven-speed 7G-tronic automatic transmission and 4-MATIC permanent all-wheel drive, the GLE simply traipsed some of the obstacles that had the GLC straining. But the huge difference, though, came on the dune just outside Swakopmund, where the larger SUV handled the powdery surface with aplomb.

The GLE comes packed with a comprehensive safety specification, including the anticipatory Crosswind Assist and Collision Prevention Assist Plus. The optional Driving Assistance Package Plus includes Distronic Plus with Steering Assist, Pre Safe Brake with pedestrian detection, Active Blind Spot Assist, Active Lane Keeping Assist and Pre-Safe Plus.

Price: R1 166 000



HEAD TO HEAD

THE “BUDGET” SUV MARKET HAS JUST RECEIVED TWO BIG PLAYERS IN THE FORM OF FORD’S EVEREST AND HYUNDAI’S SANTE FE. THERE’S A SHOWDOWN ON THE HORIZON

FORD EVEREST XLT 3,2 AUTO 4X4

The Blue Oval’s last attempt at taking on the might of the Toyota Fortuner was valiant, but came across as something too little, too late – being based on the outgoing Ranger. This time round, though, Ford has come in charging hard with the second-generation model. It boasts new looks, plenty of standard specification and importantly, that Built Tough philosophy.

Although looks are subjective, the new is certainly striking. The boxy dimensions of its predecessor have given way to a bold new design that, while lending certain elements from the Ranger, has also added more rounded corners and lines.

That rugged stance would ultimately not be as fitting if the Everest wasn’t up to scratch off the beaten track. So, that’s exactly where Ford South Africa took local media – out to play in the mountains of the Western Cape. With its ground clearance of 225 mm, body-on-frame chassis and Terrain Management System that allows drivers to choose between modes that include normal, snow/gravel/grass, and sand and rock, the Everest easily handled the rough environment.

Powered by a revised version of the venerable 3,2-litre, five-cylinder, turbodiesel motor (147 kW and 470 N.m) mated to a six-speed automatic transmission, the Everest returns a claimed average of 8,2 litres/100 km.

Inside, occupants are treated to Ford’s SYNC 2 infotainment system with voice control, eight-inch touchscreen and 10-speaker sound system with subwoofer, as well as Ford’s Blind Spot Information System, folding second and third row seating and more than 30 stowage compartments.

Price: R593 900

HYUNDAI SANTA FE 2,2 4WD 7-SEAT ELITE

Although Hyundai’s Santa Fe was never really regarded as an off-road vehicle, it would have been a complete insult to call it a soft-roader. The Korean brand has definitely approached the aforementioned status a bit with its new range-topping SUV.

One of the key features on the updated Santa Fe is that the looks have been jacked up significantly under the pen of design boss Peter Schreyer and his team. The revision makes use of new bumpers front and rear, revised headlamp layout while newly designed 19-inch alloy wheels and LED tail lights freshen up the profile and rear end.

The Santa Fe is exclusively available with Hyundai’s 2,2-litre turbodiesel four-cylinder motor with 147 kW and 436 N.m on tap. It’s certainly quite refined, as I discovered when we



left Somerset West and headed for Sir Lowry’s Pass – and sipped unleaded to the point where the average claim of 8,3 litres/100 km was just slightly conservative for the all-wheel-drive model I drove on the media launch.

The Santa Fe’s cabin exudes a premium feel, which is exactly where the company was aiming. The sombre black leather upholstery is contrasted by brushed metal look trim accents that line the fascia, centre console and door cards. Specification includes Blind Spot Detection, automatic tailgate and an Eco driving mode.

Price: R699 900



NISSAN SUV TECH

LOOK MA, NO EYES

There's something undeniably spooky about manoeuvring a vehicle without looking where you're going. Well, to be accurate, what I mean is without looking out of the windows. I was using the onboard cameras as my only means of guidance. Sort of how pilots fly in cloud, using only their instruments. It didn't take long for me to develop a healthy respect for those skilled in IMC – Instrument Meteorological Conditions, in aviation parlance.

We were blindly – in a manner of speaking – navigating our way around a laid-out course in one of Gauteng's slightly down-at-heel upmarket shopping mall parking areas. The occasion was a Nissan demonstration of its Qashqai, Juke and X-Trail compact SUVs. The point: the moderately priced SUV of today is more than just a supersized hatchback and it actually can do some of the stuff (and features some of the cool tech) more commonly associated with its big-ticket big brothers.

Now reversing cameras and even forward-facing ones, these days, can be found on pretty average cars. Many big 4x4s add a camera either side to make it easier to judge your progress, monitor vehicle extremities and avoid scrapes in punishing off-road conditions. Using clever image-stitching, they can also generate a virtual overhead birds'-eye view. It all comes together on a touch-screen dashboard display. It comes as a pleasant surprise to find them on a moderately priced SUV, instead of just on a high-end model where you'd expect to find it.

My assessment: yes, those cameras can be as useful in the urban jungle as well as the great outdoors. Suddenly those awkward parking bays become a whole lot more manageable. (The camera view operates only at low speed, naturally.)

Of course, those cameras aren't just about enabling you to squeeze into a parking spot from which it's actually impossible to open the doors. The cameras feed into Nissan's Driver Assistance package, which includes Around View Monitor, Moving Object Detection, Blind Spot Warning and Lane Departure Warning.



Control yourself

Also available on Nissan's Qashqai and X-Trail models is a suite of advanced electronic vehicle management technologies under the umbrella of what it calls Chassis Control. These include Active Trace Control, Active Engine Braking (for automatic models) and Active Ride Control.

Active Trace Control.

Mimics a front-mounted limited slip differential by managing engine power and braking individual wheels to maintain your chosen cornering line.

Active Ride Control. Not quite a magic carpet ride, but clever nonetheless. Minimises body movement on rutted roads by subtly applying brakes to stabilise the vehicle.

All Mode 4x4-i. Can distribute up to 50 per cent of the engine's power to the rear of the vehicle during on- or off-road driving. Includes Hill Start Assist and, in the X-Trail, Hill Descent Control. – ANTHONY DOMAN

PM



ROCK CLIMBING

There is immense reward in hauling your own body to the top of a wall using nothing but flexibility, cunning, and the strength of a couple of fingers. We asked Sierra Blair-Coyle, a professional climber who buckled into her first harness at age eight, how to get there.

ADVANCED

Lead climbing is a more challenging form of long-distance climbing that can be practised either in a gym or outdoors. To do it, you tie into a safety rope and then run that rope through anchors set into the wall as you move up it. Outdoors, the lead climber is the guy in the front of the train. Lead climbing also requires a belayer.

Free solo climbing is the same as bouldering, but is performed on walls high enough to cause injury or death if you slip. You – and all the courage you can muster – just climb up a big, scary wall. Solo climbers are the sort who might also enjoy wing-suit gliding or base jumping.*



***A safer alternative:** Want to experience the terror of swinging by your index fingers 300 metres up a cliff, but don't want to possibly die? Read free solo climber Alex Honnold's new memoir, *Alone on the Wall*.

BLAIR-COYLE PHOTOGRAPH BY CHRIS HINKLE

Sierra Blair-Coyle, 21, is a five-time World Cup competitor and a two-time junior National Champion.



Choose your discipline

BEFORE YOU CLIMB, you're going to spend a lot of time watching other people climb, so you'd better make sure you like your climbing buddies. In a rock-climbing gym, which is where you should start, you'll encounter two beginner-level disciplines – bouldering and top roping. Most gyms offer both, but some places may have a more robust community around one or the other. The two specialities also tend to attract different kinds of people:

Bouldering is great for extroverts and larger groups; top roping is ideal for those who want to learn with a single friend.

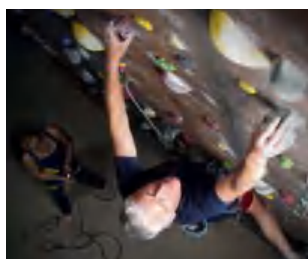
It may be worth visiting several gyms until you find a group and style you like.

TYPES OF INDOOR CLIMBING

BASIC



Bouldering, or creeping up, under, and across shorter structures (these may vary depending on the gym's size) like a crab, tends to be more social, because lots of people can climb at once. Bouldering does not require a harness or ropes, but can demand technical moves: it started out as a way for long-distance climbers to practise difficult tricks close to the ground.



Top roping, or creeping up taller walls (indoors, up to 15 metres), is better in pairs. This is the easiest form of long-distance climbing, in which climbers tackle vertical routes using a rope. In this case, a rope threaded through an anchor in the ceiling is tied to your harness. Your partner on the ground, known as a belayer, holds the other end to let you down.

Get your gear

"THE FIRST TIME you go to a climbing gym, all you really need to bring with you is yourself," Blair-Coyle says. You can rent everything you need there. Once you're hooked, you'll want these four items.

SHOES

Gripping with your feet is just as important as gripping with your hands. Gym shoes typically have a thicker sole, as they have to endure more wear and tear. La Sportiva's Mythos shoe (R1 699) is great for beginners, as the soft leather upper adapts to the shape of the climber's foot, and the upper rand's perforation allows for stretch.



CHALK

To get the strongest hold, you need dry hands, and for that you need chalk. Metolius' Super Chalk (R50 for 71 grams) is a favourite among South African climbers. The chalk is made with magnesium carbonate, which locks up moisture without caking.

CHALK BAG

Chalk bags aren't an area of climbing inclined to innovation. Some bags have a stiff rim to make it easier to dip your hand while you're hanging from a wall. Evolv's Andes Chalk bag (R337) is detailed with fabric handwoven by locals living in the Andes mountains.



HARNESS

The first few times you try rope-based climbing, you'll spend a lot of time falling into, and hanging around in, your harness. Comfort is important. Black Diamond's Momentum Harness (R975) has an ultra-comfortable waistbelt, with a pre-threaded buckle that eliminates errors when tying in. It's popular and great for beginners.



TIP! CONSIDER LIQUID CHALK

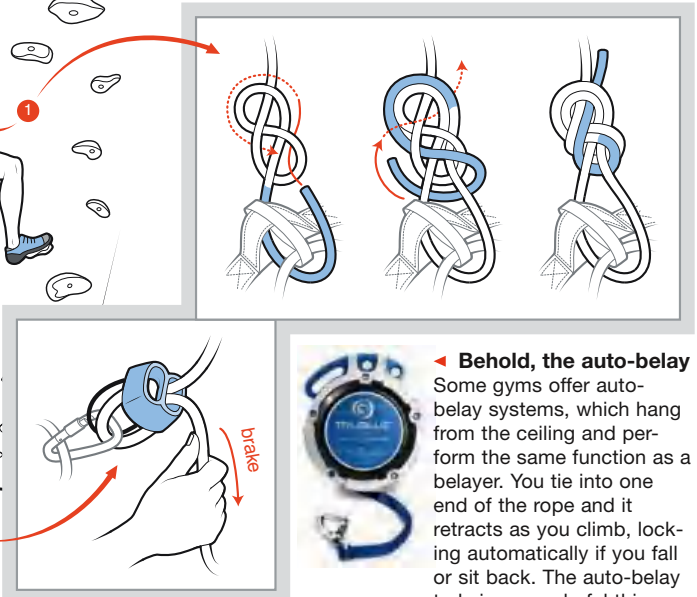
If you eventually move on to crack climbing – an advanced technique that requires jamming your hand into a crack for a hold – try Singing Rock's Magnum liquid chalk (R135 for 150 millilitres). It'll keep your whole hand dry.

3

Strap in

Top ropers take note. If you plan to boulder, you can skip this part.

Tie your harness to a rope hanging from the ceiling using a figure-eight knot ①. Your partner, the belayer ②, will clip in to the other end using a carabiner attached to a belay device ③, which looks a lot like the front of a pig's nose. The belay device functions as a friction brake, lightening the load the belayer has to support if you fall. As you move up the wall, the belayer removes slack from the line. If you lose your grip, or you're ready to come down, the belayer locks the rope in the belay device by pulling the free end out to the side, leaving you comfortably dangling. Most climbing gyms offer intro courses or lessons in both knots and belaying.



Behold, the auto-belay

Some gyms offer auto-belay systems, which hang from the ceiling and perform the same function as a belayer. You tie into one end of the rope and it retracts as you climb, locking automatically if you fall or sit back. The auto-belay truly is a wonderful thing.

4

Pick your problem

UPON APPROACHING your gym's top-roping wall or bouldering course, you'll notice knobs and handles everywhere. How hard could it possibly be to climb a wall that's got more nooks than an English muffin, you might think. Here's what makes climbing hard: you don't get to use all the holds. You have to follow a preselected route, which climbers call a problem. Some gyms will mark a problem with coloured tape. In other gyms you'll follow holds that are all the same colour. The problem's difficulty is rated on one of two different scales, depending on whether you're bouldering or top roping. "Harder routes have worse holds – sometimes they're smaller, and sometimes they're harder to grab," Blair-Coyle says. "You might have fewer holds that are further away, and you might be in awkward positions."

Bouldering courses rated a 4 or higher, such as the one Blair-Coyle is climbing above, have problems that require precarious positions and even leaps.



PROBLEM-RATING SYSTEMS

Sport Climbing

EWBANK SYSTEM

Largely used in South Africa, Australia and New Zealand, the Ewbank Decimal System is an open-ended grading system that starts with one – an easy route that requires little skill – and escalates as the difficulty increases. The Ewbank system rates the entire climbing experience, including technical difficulty, exposure, length, rock quality and protection.

Internationally there are other grading systems, including the American Yosemite Decimal System, the British or UK grading system and French numerical system. Beginning climbers will begin to sweat at about grade 14 on the Ewbank system.

Bouldering

THE FONTAINEBLEAU SYSTEM

Named after the region of France famous for its highly concentrated bouldering areas, the Fontainebleau system is an open-ended grading system that starts at one. Most problems are rated from only four. However, once the scale reaches six, a suffix is added to distinguish difficulty and a + can also be added to indicate a change in difficulty. For example, a climb rated 6B+ is more difficult than a 6A route, but less difficult than a 6C route.

The so-called Font system also includes colour circuits, which range from yellow to black.

Another popular boulder grading system is the American V-scale system, which grades between VB and V15, with the difficulty increasing as the number adjacent to the V increases.

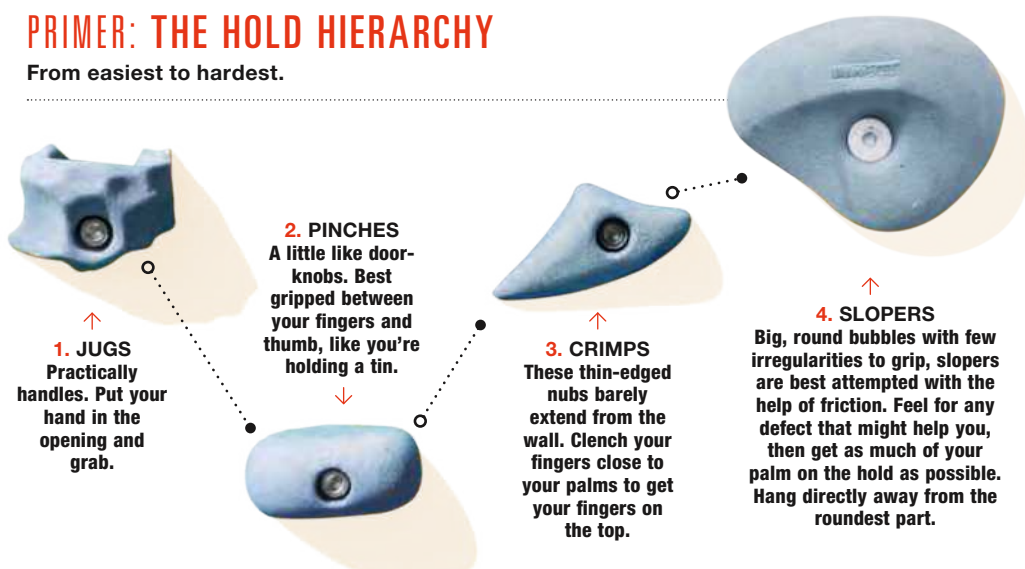
5

Climb

BEGIN AT THE HOLD marked Start, put a hand on it, and crawl along the holds on your problem. Easier problems often have more holds than you need, so always choose those that will get you in position to best reach the next comfortable spot. There are tricks to moving your centre of gravity around that you'll learn as you get better, but usually you want to reach for a new hold, move your feet up to a set of new holds, and then stand. Keep most of the weight on your legs, because your arms will tire first.

PRIMER: THE HOLD HIERARCHY

From easiest to hardest.



FIND YOUR INNER MONKEY

When faced with indecision, resist the impulse to contract your arms and hold close to the wall. Think like a monkey: a monkey doesn't cling to a tree, but keeps its body relaxed while it hangs. "Climbing is really about learning to use your body so you're minimising the strength you require," Blair-Coyle says. "You want to try to keep your arms as straight as possible when you can."

GETTING DOWN

If you fall, don't panic. Just alert your belayer by saying "falling". If you're not falling, but you've had enough, say "take". Either way, your belayer will lock the rope in the belay device, which he can do quickly. Then just sit back like you're sitting in a chair. Trust the rope. It will hold you. Kick gently off the wall as your belayer lets you down.

With thanks to Peter Steadman and Kate Mullen, owners of the Stronghold Climbing Gym in Los Angeles. Special thanks to the staff at CityROCK climbing in Cape Town.

PM

SKILLS

THE ART OF FIREWOOD

It can be so much more than chopping and splitting.

BY CJ CHIVERS

One crisp midwinter dawn, after a cup of hot coffee and a plate of warm eggs, a weekend routine began. I roused the kids, who groaned and briefly resisted. While waiting for them to dress and find their way downstairs, I stepped out to the chilly shack and checked the tools and safety kit – padded earmuffs, impact-resistant goggles, heavy gloves, srench (chainsaw adjuster), wedges, rope, first-aid box, and a freshly sharpened spare chain. The saw, a 70,7 cubic centimetre Husqvarna, brimmed with bar oil and fresh 50:1 fuel.

I walked down the gentle slope behind our house. At the small woodlot at the edge of our neighbour's property were three trees that needed to come down. One, a huge locust, had split almost from the ground to six metres up. It swayed and creaked in a light breeze. Beside the locust was a thick maple that was succumbing to the unrelenting industry of carpenter ants, which had softened a wide band from about a metre and a half above the soil to more than three metres overhead. Heart rot had followed the ants' intrusion, leaving

much of the trunk as soft as Styrofoam. Without an intervention, this tree was going to meet a violent and unpredictable end.

Another ant colony had settled into a second maple nearby. Weakened, that tree leaned precariously over a shed. These were problems that were not going to solve themselves. Our neighbours had invited us to remove the trees and keep whatever firewood we wished.

Soon the kids had joined me, and we set to work on a labour that would last, off and on, into spring: felling, limbing,

Collect firewood – and create a bond with family and surroundings.



bucking, and then hand-carrying the wood home, where it would be split and then stacked for seasoning. We would do it piecemeal, a few hours at a time, working in the effort between their homework and other demands.

We began by clearing a few bits of brush under the first tree, making a safe place to work and an open escape route in case of the unforeseen. We chose the felling direction, and discussed the spots for notch and felling cuts.

The children backed off before the two-stroke engine roared to life. I released the brake. The chain began to spin. A long chore that I would look forward to each weekend had started – harvesting future heat, together, and almost for free.

In an age when many people heat with gas, oil, or electricity, the richness and rituals of gathering and seasoning wood for homes risk fading into our past. Those who use wood heat do more than save money, live locally, and keep some of their cash from flowing offshore. They tap into a primal activity, and often enjoy rewards beyond what they might expect.

What can I mean? The varied tasks related to heating a home with firewood can create an intimacy with your surroundings and with your family that is as sustaining as the warmth the wood provides as it burns.

Even the woodpiles themselves become a tangible library of memory. Each section of our stack tells of its source. The once bright yellow

splits now slowly dulling to brown came from an old locust that had snapped in a storm. The rich grey section with heavy bark has its origins in a leader off a massive, trident-shaped oak that crashed to the ground after a storm. That oak piece – my kids named it the beach-ed whale – had to be hand-split in place and carried uphill, chunk by chunk, to the pick-up, excepting what the kids ferried home in a hand-pulled sled.

Firewood comes to us opportunistically. A neighbour will want a tree felled. A storm will blow through and knock down limbs or uproot and topple entire trees. A few trees will have to go to make way for a home addition or access to a new lot. Sometimes it almost seems as if the wood finds us.

Occasionally the wood can carry other meanings. We cut and carted away the white birch rounds from the sprawling grounds of a body corporate at the request of a friend who was managing the place. The property had lost trees in a storm, but the contractor hired to clean up the mess had left much of the wood behind. My children and I ended up with the bounty, glad to help, grateful for the fuel. Not long after we split and stacked a few truckloads, our friend was diagnosed with cancer. She passed with startling speed. Every time we bring a sack of birch inside for the stove, we think of her, aware of the emotional power a wood stack can hold.

Under the trees on that cold winter day, the work took its shape. We felled the first maple, then the locust, limbed much of them, and started to carry home the rounds, armload by armload. This would take a

HOW TO FORAGE

- 1 Find wood from willow, pine or similar trees for kindling. Although these woods burn quickly, they light easily. (Fires made with them are also easier to extinguish because they don't leave much of a charcoal bed.)
- 2 Be wary of wood that you find on the ground, as it's more likely to be wet or rotten.
- 3 Most of your campfire wood should come from low branches. If they snap off easily, they're dead already and will burn well. If they don't snap off easily, leave them alone.
- 4 For larger, longer-burning pieces of wood, find a nut-bearing tree. Such trees are hardwoods, which means they're denser and have a higher Btu. (See below.)

Dry wood in descending order of Btu in millions per cord

		
Oak	Maple	Hickory
27,6	25,5	24,6
		
Elm	Birch	Walnut
20	20,8	22,2
		
Aspen	Pine	Willow
18,2	17,7	17,6

long time. But we had been lucky not to have a barrage of winter storms, and we knew we should collect and move as much as we could before winter bore down and covered the site in snow, locking the wood in ice.

The next weekend we returned. And then again, until the wood was frozen up tight. Still, we had plenty to do. Until recently, a weathered stockade fence stood along our southern property line. A previous owner had installed it, and for a few years it had been sagging. Then came Superstorm Sandy in 2012, which neatly snapped a few of the rotting posts at the ground on the way to blowing down several sections of fence.

This led to an epiphany. Why pay the timber costs for a new fence? Why even replace the fence with a fence? What if, instead of rebuilding a suburban standby, we built a wood-seasoning rack along the property line that would provide the same function – privacy and a windbreak – for a portion of the cost but would

ISTOCKPHOTO/OMGIMAGES

ILLUSTRATIONS BY JOEL KIMMEL



SIGNS YOUR WOOD IS WELL SEASONED

✱ **It doesn't smell like wood.** Most of the woody scent you get is caused by moisture.

✱ **It's dull in colour.** Seasoned wood should look grey.

✱ **It's not heavy.** Water makes up as much as three-quarters of the weight of a green piece of wood.

✱ **The ends have cracks.** As the wood dries out, it becomes more brittle.

✱ **The bark is missing or comes off easily.** When the moisture goes, the bark usually goes with it.

✱ **It sounds hollow when you hit it against something.** (Probably best if that something is another log.)

be far sturdier, more handsome, and useful, too?

I was busy with work, but scrounged the hours to remove what remained of the old stockade. Then I paid a carpenter friend to install a basic rack made with paired pressure-treated 100 x 150 posts and 50 x 150s running low and parallel to the ground, like baseboards.

A crude but eminently sturdy and functional system had taken form. Each section held more than a half cord. With nine sections and a southern exposure, our would-be fence amply stored (and cured) a sizable portion of our annual firewood needs while taking up almost no yard space. And it looked good.

With time, however, flaws in its quick design emerged. First the posts heaved ever so slightly during seasonal freezes and thaws, forcing the racks out of their original parallel arrangement. This not only looked bad, but it also changed the way the firewood sat, so much so that one stack between the posts bulged and collapsed in another hard storm.

Restacking is labour lost. So, as the last of the seasoned firewood found its way into our pair of woodstoves, and as we found a new source for wood but could not work with it until a thorough thaw, it was time for an upgrade.

Using a level, heavy bar clamps and a comealong for tension, and framing timber to force the posts back square and true, we straightened the posts, bringing each perpendicular to the ground and parallel to the others. These we locked in place with newly purchased pressure-treated planking

about a metre above the original bottom rack, each resting on a cleat for extra support. In one rack we framed the opening for a small gate.

When winter loosened its grip, we returned to the trees at the edge of the woodlot out back, and finished cleaning them up. Our neighbours lent us their John Deere 52 log splitter, a minibeast and a gem from the early 1980s that had become slightly balky with age. We commenced the next step: splitting the gathered fuel to size.

After a few shifts I managed to break the pull cord off the starter. A call to a friend who repairs commercial fishing boats led to a quick session in the yard, during which we removed the starter, rethreaded and tied in the cord, and then cleaned and tuned the carburettor. Soon the machine was purring, its old Briggs & Stratton engine contentedly revived. Over the course of the next few weekends my sons and I converted about ten cords of green wood into splits.

By then spring had warmed the yard. Potatoes were sprouting, and asparagus, too. The woodstoves in the house and the shack were clean

and silent, idle until fall. The new green firewood was neatly piled about the property, beginning to dry. The chainsaw was cleaned and ready to be put up for the warm season with a fresh tank of fuel.

We were done. And we knew the satisfying feeling of being, in one area at least, well prepared by our own sweat and our own hands. My only regret was that it was over. We'd have to wait another year to resume.

In an age when many heat with gas, oil, or electricity, the richness and rituals of gathering and seasoning wood for homes risk fading into our past.

5 WAYS TO IMPROVE YOUR FIREWOOD

With thanks to John Gulland at woodheat.org.



1 Stack wood in a single row, out of the shade, with enough space between the pieces to allow air to pass through. This exposes more wood to sunlight and breeze, which helps dry it out faster.



2 When stacking, use a criss-cross pattern to make pillars at each end for stability. They act as bookends for the wood in the centre.



3 Before splitting wood on a stump, secure an old tyre to the top of the stump. After you split the wood, it will lean against the tyre instead of falling to the ground.



4 Cut cords shorter than you think (around a third of a metre long), split them smaller than you think (8 to 15 centimetres wide), and vary the size of the splits. The logs will be easier to carry, and the fire will be easier to build.



5 Check your local authority's policies on cutting your own firewood.

THE SCIENCE OF

NO MATTER WHAT YOU THINK YOU'RE DOING, you're mowing your grass wrong. Firstly, you shouldn't be palming the job off to a private contractor unless you really don't have any time, or your plot is massive or you can't enlist your offspring. Secondly, it really isn't difficult to maintain if you start with a well laid out plan.

Mowing is the most basic practice for maintaining lawn turf. Performed at the correct height and frequency is essential to the health and density of the lawn. Removing leaf tips induces plants to form new sprouts, increasing stand density. Mowing can affect water quality, too. And healthy stand can withstand more pest pressure and will then require less pest control. The denser turf cover also helps prevent soil erosion, which is an important pollution problem.

The height at which a given perennial grass can be cut and still survive for extended periods is directly related to its ability to produce enough leaf surface to keep up photosynthetic production of food. Basically this ability is related to the type and habit of growth found in the grass. (The length of internodes, the number of stolons or rhizomes, and the number of basal buds all influence the amount of leaf mass produced by a given grass; hence, its ability to withstand low heights of cut.)

Turfgrasses are well adapted to frequent mowing, but mowing too short will reduce the vigour of the plants because less leaf area means less photosynthesis. Also, there is a direct relationship between cutting height and the amount of roots a grass plant can maintain. Lowering the mowing height reduces the root system. This restricts the ability of the plant to absorb water and nutrients. In recent years, recommendations for mowing height have steadily increased for home lawns. Current standards suggest between five and seven centimetres. Higher cut lawn grasses are more stress tolerant, which is especially important during the summer heat period. Taller grass plants with higher density will also have a shading effect on the soil surface, which reduces germination of weed seeds. This is an excellent way to reduce herbicide use, especially where the lawn is properly fertilised and watered to maintain vigour.

How often you mow is also an important consideration in the maintenance programme. Infrequent clipping allows the grass to grow to such a degree that any subsequent clipping removes too much leaf surface. At no time should clipping amounts in excess of 1/4 to 1/3 of the total leaf surface be



LAWN MOWING

It takes more than a few ice-cold beers and a weekend to get your lawn in a manicured state, but you can do it on your own.



OUR NEW FAVOURITE TOOL: LAWN STAR PRO 48 LSMP 8548 MB

The petrol-powered push mowers from your Pappa's days required a song and dance of priming and setting a choke, and were smokey two-stroke noise machines. This grass-eating demon is of the 190 cc four-stroke variety with overhead valve, air cooling and delivers 3,7 kW of cutting power and 11,2 N.m of torque at a constant 3 060 RPM. Revs are constant because there's only two speeds, off and on. If you want you can mate the Briggs and Stratton cast iron sleeve engine to a bigger chassis by opting for the Pro 57 and gain 20 extra litres on the grass catcher, but the 50-litre grass catcher on

the Pro 48 is more than enough for most people. You get a mulching blade and stopper included, plus the tools to do the conversion, and with 11 position/ ranging from eight to 65 mm heights you're covered for all types of grass and lawn styles. Lawn Star back the product with a 24-month domestic use warranty and 12-month commercial use warranty, and since assembly is done locally, you won't need to go far to find spares or a tune up.

removed at a given mowing. Removing larger amounts of leaf surface will result in a physiological shock to the plant, cause excessive graying or browning of the leaf tips, and dramatically affect the photosynthetic production of food, depleting root reserves.

Add to this the excessive mulch clippings that may smother the grass and provide the perfect environment for disease organisms and insects. Excessive clippings should be removed promptly. To prevent thatch build-up you should catch and bag clippings every alternate mow. The frequency of mowing must be governed by the amount of growth. In turf, growth is related to weather conditions, season of the year, soil fertility, moisture conditions, and the natural growth rate of the grasses.

A general rule of thumb is not to remove more than one-third of the total leaf surface when mowing your lawn. This may require mowing every four to five days during rapid growth in the spring.

CHOOSE YOUR TURF

Are you #TeamBermuda or #TeamBuffalo?



Bermuda grass can be divided into two classes, common and hybrid. You want the common type because it's coarse-textured and more drought-tolerant. Both common and hybrid Bermuda grasses should be fertilised 4-6 times per year. Bermuda goes dormant when the temperature drops. Many golf courses and homeowners over-seed with perennial ryegrass for the cooler months. This keeps the lawn nice and green instead of brown. The ryegrass dies off when the temperature climbs back up again, letting the Bermuda grass take over. Mow between 15 and 35 mm for best results. Water when 50 per cent of the lawn shows signs of wilt.



Buffalo is hardy and drought tolerant, but needs to be fertilised every two months or the softer variants will lose colour, health and vitality. Annual iron supplementing in either spring or autumn. Regular mowing will keep the lawn from developing too much thatch, will reduce the risk of damaging the lawn through shock and will slow Buffalo runners from creeping into surrounding gardens and promote more green leaf growth. Buffalo is prone to disease infections like Brown Patch, which should be treated by stopping fertilising during the outbreak, cutting the grass higher and watering in the morning only on watering days. Mow between 35 and 65 mm for best results. Water in the morning after 30 per cent of the lawn shows signs of wilt.

ESTABLISHING TURF

The essential steps to amazing lawn

SOIL TESTING

A soil test will determine the pH level of your soil which you can then adjust by adding lime as a fertiliser. Lab testing will uncover the mysteries of the soil and the amounts of phosphorus, potassium, and organic matter present, but a probe test kit (available at any large nursery) will give you a basic pH reading. Pro tip: You want a pH of 6,2-7, anything higher is too acidic and lower is alkaline. Raise pH by adding organic compost like decomposing pine needles or lower it by adding lime.

ROUGH-GRADING

Remove all debris and large stones, till the soil and bring area to rough-grade before trying to correct the pH. If you need to add or replace topsoil, rough-grade to the contour of the final product – it will save you work later.

LIMING

Speak to a horticulturist to get exact lime to soil ratios working off the results of your soil test, but a general rule of thumb is 45 kg of ground limestone per 100 m² of soil.

TILLING

Till the seedbed to a depth of 10-15 cm, making sure the limestone, topsoil and/or fertiliser are evenly mixed through.

FINISH-GRADING

Rake the area to finish-grade just before to seeding.

STARTER FERTILIZER

Use a starter fertiliser immediately before seeding, work 45 kg per 100 m² into the top 25 mm. The fertiliser must be turf grade, having an approximate 2-1-1 ratio and containing 35 per cent or more of the total nitrogen as water insoluble or controlled release nitrogen. If you only have farm grade fertiliser, (soluble nitrogen) use 10 kg per 100 m² and refertilise after six weeks of growing weather.

SEEDING

Late summer to early autumn is the best time for seeding permanent turfgrass.

COVER SEED

Rake lightly or drag area to cover seed no deeper than 10 mm.

SEED-SOIL CONTACT

Roll lightly to firm soil around seed.

MULCHING

Mulch seeded area with clean straw. Light mulches (some soil showing through mulch) may be left on the area to decompose. Heavy mulches (complete soil coverage) should be removed from the area within a few days after seed germination.



Watering in the morning provides the lawn with water in the soil throughout the day when the weather is warmest and when the grass is most actively growing. When lawns are watered at night, much of the water drains away through the soil before the lawn can use it – this wastes water. When water is left sitting on the lawn surface overnight, this will greatly promote fungal diseases.

RESPECT THE TURKEY

How not to embarrass yourself at the holiday table. BY WYLIE DUFRESNE

If you take a close look at Norman Rockwell's iconic painting of a family gathered around their holiday dinner, you'll notice that the grandpa, in a matter of seconds, is going to pick up the carving knife and hack the bird apart right at the table. Now, maybe he happens to have great knife skills and he will not, in fact, dishonour the meat before everyone's very eyes. But that is unlikely, because most people don't know how to properly carve a turkey. What the man should do is tell his wife to hand him the bird so he can take it back to the kitchen, put it on a cutting board, and carve it slowly and properly, without the entire family looking on.

I've been the designated turkey carver in my family for years. Somehow I've managed to get away with

doing very little cooking during the holidays, but everyone assumes I'm going to take care of two important tasks: pulling corks out of wine bottles and carving. I enjoy both jobs, and I find the carving almost therapeutic. While the whole family is busy gathering around the table, figuring out where to sit and whose wineglass is whose, I get to escape to the kitchen and spend a few quiet moments with the bird. I can't overstate the importance of careful carving: someone (ideally not you) has spent days planning and preparing the meal, and hours watching over the meat in the oven. The last thing you want to do is mess it up at the end. You owe it to everyone to understand the anatomy of the animal and remove the meat in the proper way. Start by letting the meat rest for up to 45 minutes. Then do this.

THE TOOLS

All you really need for this task is a knife and a fork. I've used all types, depending on what I'm able to find in other people's drawers, but these are best:



► The curve of a traditional fork can get in the way. The **F Dick 18 cm straight-tined fork (A)** is flat, which means that when slicing you can run your knife straight down the back of the fork and into the meat.

► The **Honesuki-style boning knife (B)**, usually 14,5 centimetres long, is designed for butchering poultry. A suitable (and easier to find) alternative: the **Wüsthof Classic 15-centimetre boning knife (C)**.

Go to popularmechanics.com/turkey for the definitive VIDEO of how to carve a turkey.

HOW TO CARVE A BIRD



1 With the bird on a cutting board inside a sheet pan, make an incision between the body and the drumstick.



2 Once you've cut through skin and meat, use a hand and your knife to crack the thigh joint.



3 Separate drumstick and thigh by working your knife into the apex of the V formed by the leg and pulling.



4 To remove the thigh bone, slice along it until you can see the end, then pull up on the end while scraping the bone with the knife. Slice the meat.



5 Remove the wing the same way you separated the drumstick and thigh. Pull the wing out until you see the joint and run your knife through.



6 To remove each breast, slice along the rib cage, then downward, pulling the entire breast off as you slice.

A PHOTOGRAPH BY TODD MCLELLAN

DISASSEMBLY REPORT

PAY PHONE

MODEL: PROTEL XP1230

PRODUCED: LAKELAND, FLORIDA

TIME TO DISASSEMBLE: 4 HOURS, 45 MINUTES

NUMBER OF PARTS:

453

NOTES: For years, if you were away from home and wanted to make a phone call, pay phones were your only option. Even now that most of us have phones in our pockets, pay phones aren't going anywhere. Telecommunications regulatory bodies such as the USA's Federal Communications Commission (FCC) suggest having them in certain places for the sake of public safety or welfare (such as outside a police station, where you might need to make a call after being arrested). Pay phones manage to connect calls, set prices, and accurately collect payment using only electricity drawn from the phone line. They're also basically bulletproof, devised to withstand all manner of vandalism and theft.



POWER

When the **handset (22)** is removed from the **cradle (23)**, the lever releases and triggers the **hook switch (21)**. That allows the phone to start drawing power, giving the user a dial tone – the signal that the phone is ready to be used. During a call, the 48 volts of electricity supplied by the phone lines power all the phone's electronics, including, crucially, its **master controller (3)** and **LCD screen (1)**. The phone has a rechargeable **NiCd battery (2)** used for only one purpose: when the handset is replaced in the cradle, the phone has to either bank the payment for the call or return coins to the caller. Each call charges the battery just enough to carry out this operation.

PAYMENT

The XP1230 offers two ways to pay: card or coin. At the time this phone was designed, calling cards were

used more often than credit cards. The **card reader (27)** built into the phone's **upper-housing faceplate (26)** accepts either. Coin payments are more complicated. When an object drops through the coin slot in the **chrome faceplate (24)**, it falls into the **enclosure (6)** of the **electronic coin mechanism (4)**. As it falls, it passes by two pairs of wire **coils (5)** and iron discs. One pair emits a high-frequency alternating current, which measures the coin's surface characteristics. The second pair emits a low-frequency current that penetrates the object and reveals what it's made of. Combine the two and you've got a good way to distinguish a genuine coin from a poker chip. Assuming it's a coin, the payment proceeds into the **escrow relay (9)**. If the call isn't completed, a **coil (8)** powered by the battery tips the relay to the right, sending the coins down the **coin chute (11)**

and into the refund gate. If money is owed, the relay tips to the left, and the coins fall into the coin **box (17)**.

SECURITY

The XP1230 has a number of features designed to keep it intact. The coin box, with a healthy capacity, is a target for theft. It fits into a hole in the phone's **lower housing**

(25), where the **coin-box spring (19)** holds it tightly in position behind the **vault door (16)**. Two mechanisms must be unlocked to remove it. One is built into the **coin-box lid (18)**, and the other is a four-armed **locking mechanism (15)** behind the vault door. Until turned by a **T-key (14)**, the arms fit into slots in the body of the phone, keeping the door shut.

Coins can also be pilfered through the **refund gate (13)**. Vandals used to jam a sock inside the coin return in the morning, then go back in the evening, pull the sock out, and collect the coins that had got stuck above it. To prevent this, the **coin-refund door (10)** is rigged to block access to the coin chute when the door is opened.

The other major target for theft is the handset. To prevent cutting, the **lanyard (20)** that connects it to the phone has steel braided sheathing on the outside and a heavy-gauge stainless-steel wire down the centre. The **lanyard anchor (12)** keeps it securely fastened to the **upper housing (7)**. Unfortunately, there's nothing to keep it sterile. – KEVIN DUPZYK

REASONS YOU MIGHT FIND YOURSELF IN NEED OF A PAY PHONE

- Your cellphone died.
- You are in a sub-way station.
- You are a fan of prank calls and don't know how to turn off your caller ID.
- You miss the good clean fun of the 1950s.
- You need change and are hugely optimistic.
- You are having an affair.
- A crime is being

committed and you're still in your civilian clothes.

- You don't have pink eye and are interested in catching it.





PROJECT

BOARD GAMES

As you head into the new year and enjoy the holiday period, here are four quick and easy projects to help you while away a spare afternoon in relaxing fashion – or even to craft a last-minute Christmas gift. Runner-up entries to our DIY Challenge No 1 (create something using only a sheet of plywood) they require the minimum of expertise.

Words on wheels

STORE YOUR READING MATTER NEATLY, WITH THE CONVENIENCE OF PORTABILITY AS AN OPTION

Rather craftily, Pieter de Villiers called his plywood creation a “POPULAR MECHANICS Magazine Rack”. He says that you don’t need to go thicker than 16 mm, which makes this quite an economical project.

If you are able to get your board cut by your hardware store, that will make your life a lot easier. Alternatively, you will need a circular saw.

1



Figure 1

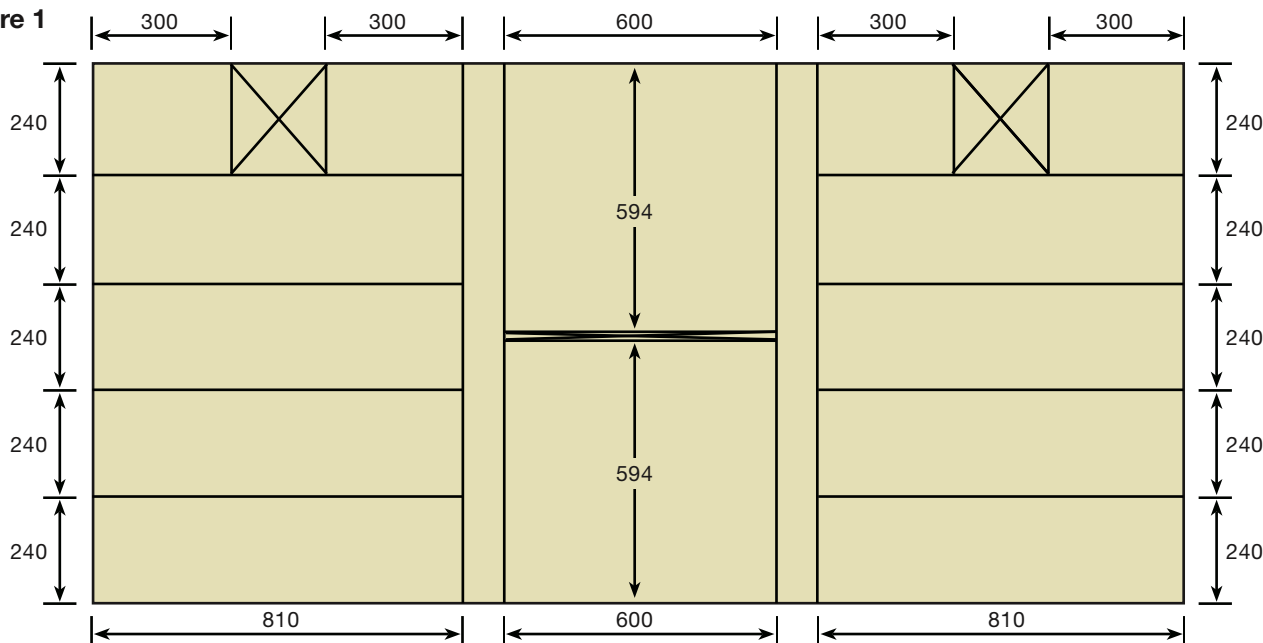
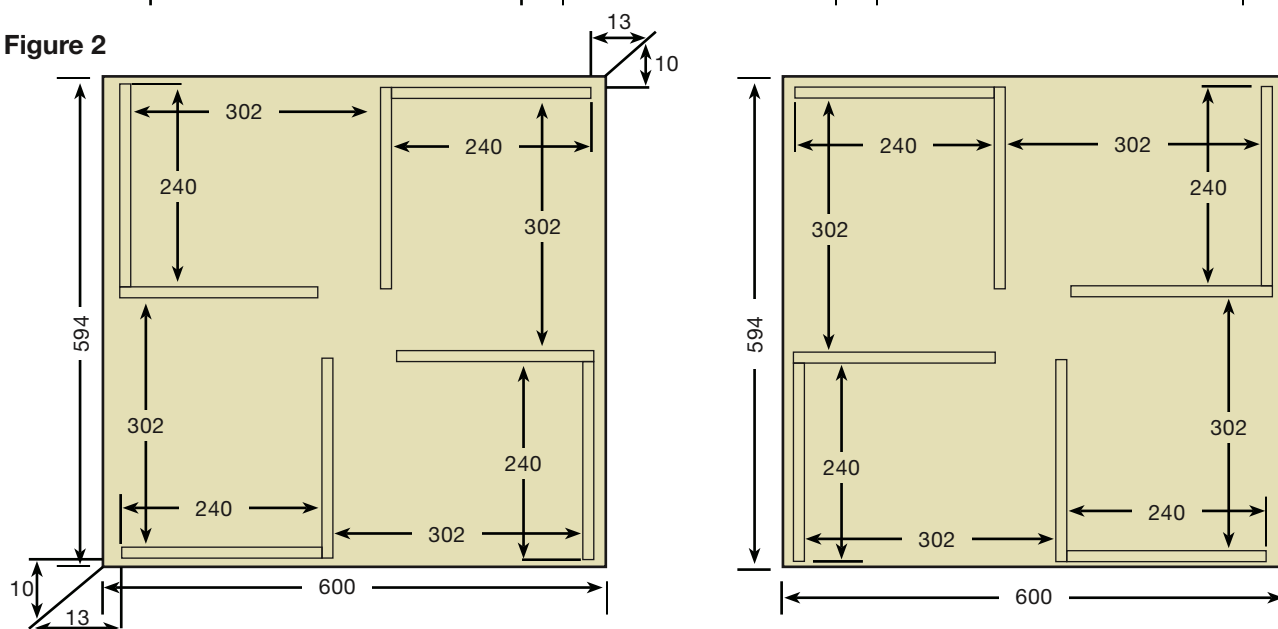


Figure 2



Materials

DESCRIPTION

1	One sheet of any type of plywood – 16 mm thick will do for this project
	Wheels (optional – attach underneath, which makes reaching all four sides easier)
	Wood glue
	Sanding paper
	Varnish

Tools

DESCRIPTION

	Circular saw (optional)
	Router
	Chisel

STEP 1

Cut the plywood into sizes/parts as follows (refer to **Figure 1**):
 8 x upright support panels (810 x 240)
 2 x top and bottom panels (600 x 600)
 4 x shelves (300 x 240).

STEP 2

Sand down the flat faces of the boards and the edges to the desired finish

STEP 3

Cut the slots/recesses on the top and bottom panels – 5 mm deep – with a router so that the upright panels fit snugly into them (refer to **Figure 2**). The slots end 10 mm and 13 mm from the edge of the panel, respectively (as per **Figure 2**). Square off the rounded router edges (in the slots) with a chisel.

Dry fit the upright panels before glueing.

Note: the slots in the top and bottom panels are mirror images of each other.

STEP 4

Glue the upright panels to the inside of the top and bottom panels' slots (put some weight on top of the magazine rack for a couple of hours so that the glue can set – use a stack of PM magazines as weight).

STEP 5

Optional: attach wheels underneath or corner blocks (use some of the offcut material). Varnish the magazine rack.

(Note: the magazine rack shown in the photos was constructed with more than one sheet of ply wood, hence is taller than the description above)

PROJECT



2

Just a-sitting and a-rockin'

Jos Froom describes his rocking horse design as an ideal weekend project for Dad or Granddad. Preferred ply thickness is 22, but 18 will do (that's in fact what he used, because it was all that the hardware store had available on the day).

MATERIALS

Rocker boards:	1 000 x 200 (2)
Seat board:	72,5 x 240 (1)
Head front board:	630 x 220 (1)
Cross sections:	500 x 150 (2)
Tail board:	500 x 150 (1)
Strut sections:	275 x 150 (2)
Handle:	200 long, 22 square. Then round edges for about 80 each side (1)

INSTRUCTIONS

Cut wood to the size of the plan for final use. The radius of the rockers is 1 000 if you want to cut them with the router using an extension arm.

It is advisable to have the rocker a little wider if cutting the radius with a router bit.

Edges of the head, tail section and the seat can be rounded off with a router rounding bit or sanded to suit.

HEADBOARD SUITABLE FOR A QUEEN-SIZE BED

Construction is straightforward and follows from the cutting plan.

MATERIALS

20 mm plywood, cut to the following sizes:

1. 1 200 x 50 (34)

2. 400 x 50 (2)

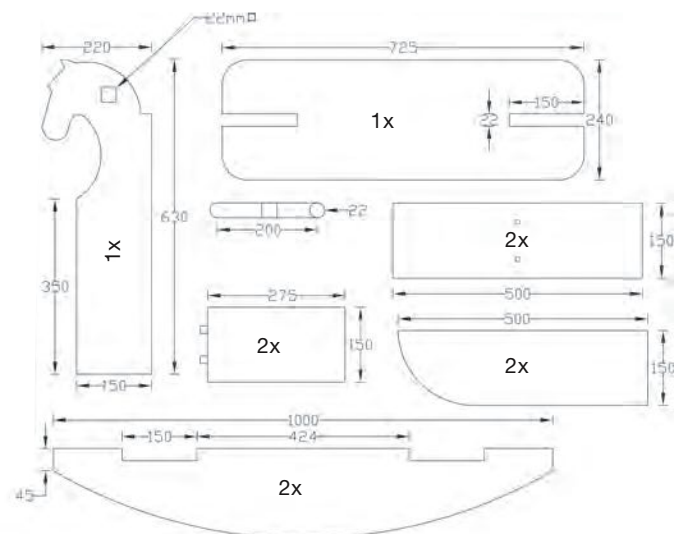
Wood glue

Clamps

Suitable brackets to mount the headboard to the wall



3



Assemble the rocker and cross section, followed by the head board with the seat. Then add the tail section.

The unit can be assembled with wood screws or wood dowels and can be painted and decorated with a tail to suit.

4

COAT STAND

Again, construction is pretty basic (see below) and follows from the cutting list.

MATERIALS

20 mm plywood, cut as follows:

- 1 200 x 150 with two 50 x 50 cutouts at one end (1 required)
- 1 200 x 100 (2)
- 1 200 x 50 (2)
- 360 x 50 with cutouts to form coat hooks (2)
- 65 x 50 with cutouts to form hooks (2)
- 500 x 50 (1)

7. 400 x 50 (3)

8. 300 x 50 (2)

9. 200 x 50 (6)

10. 100 x 50 (4)

11. 60 x 50 (2)

12. Wood glue

13. Clamps

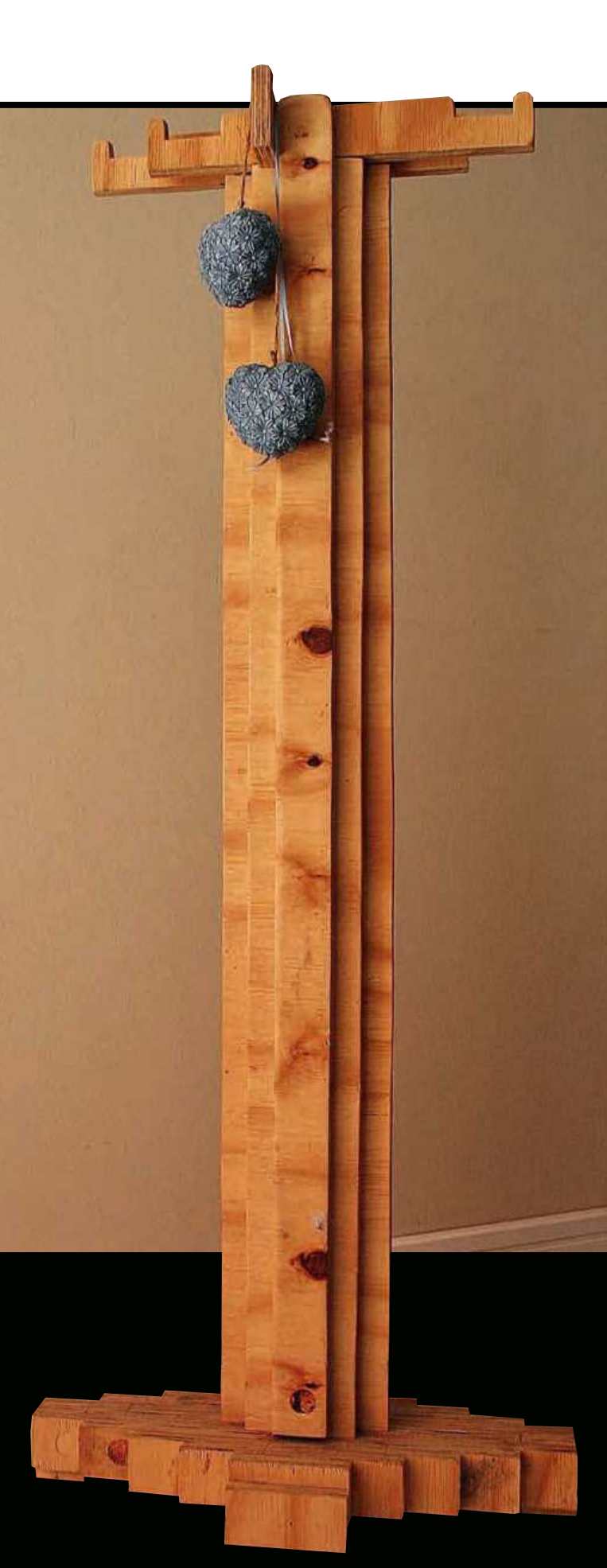
ASSEMBLY

Items 1 to 3 form the upright.

Items 4 and 5 form the coat hooks.

Items 6 to 11 form the base.

★ Plans and cutting lists for 3 and 4 are available on our Website. Go to Home How-To at popularmechanics.co.za



WIN! with our home workshop challenge

AND ANNOUNCING:

Workshop Challenge No. 4

Accept the **PM Home Workshop Challenge** and a **Makita DHP458ZK Cordless 18V Lithium-Ion Impact Drill Kit**, valued at **R6 386**, could be yours.

THE THEME: IN THE GARDEN

Summertime and the living is easy. And a lot of the time it's outdoors. Whether your garden is the green leafy kind or the austere Oriental kind, there's bound to be a way it can be enhanced with your own efforts. We're thinking daybed, brick braai, water feature, treetop deck, unusual planter, labour-saving device... with just one condition. Unlike Challenge No. 3, this time around you are required to creatively use at least one power tool in putting together your project. Your scope is as wide as the imagination allows.

THE PRIZE:



Makita DHP458ZK Cordless 18 V Lithium-Ion Impact Driver Drill Kit. This top-of-the-range Makita 13 mm impact driver drill features a battery indicator that displays the remaining battery charge; twin LED lights that illuminate when the trigger is pressed; and three functions – drilling, hammer action and screw driving. The **DHP458ZK** provides plenty of power for demanding tasks, with 21 torque settings to choose from – giving you perfect control and a maximum torque of up to 91 N.m.

This model is extremely compact, with a two-speed metal gearbox and steel keyless chuck. It features a rubberised grip, an extended side handle for greater control, a reversible belt clip for both left- and right-handed operation and a twin bit holder.

Included in the prize are a **Makita DHP458ZK impact driver drill** (supplied in a handy **carry case**) with **2 x 4,0 Ah Makita Lithium Ion batteries** (BL1840, which recharges in 36 minutes) and a **Makita compact fast charger** (DC18RC).

To find out more, visit www.makita.co.za, like Makita on Facebook **Makita-PowerToolsSA** or call 011 878 2600.

Your project will appear in a future issue of **POPULAR MECHANICS**.

Email your plans and a picture of the results, by 13 January 2016, to popularmechanics@ramsaymedia.co.za.

For full competition rules, see www.popularmechanics.co.za/workshopchallenge

Makita **Popular Mechanics**

SHOP NOTES



We are always looking for clever solutions to everyday problems. Email your shop notes to popularmechanics@ramsaymedia.co.za

A BOTTLE OPENER FOR THE WORKSHOP

Take a bit of scrap board easily gripped by hand and drive a nail through it so the head remains about a centimetre above the surface. Bend the shank back against the opposite side of the board. To open a bottle, use the nailhead to grip the cap, then pull. Assemble before consuming beer.



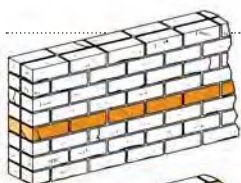
The bricks in the wall

Getting headers and stretchers from hod* to course and wythe isn't as simple as it sounds. When building a brick wall, a mason uses a particular formula for orienting bricks, called a bond pattern. Today, brick is rarely load-bearing, but when bonds originated their purpose was to align bricks and vertical joints for structural integrity. They persist in non-structural uses because of their pleasing aesthetic qualities.

THE WALL

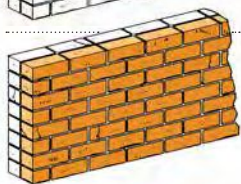
COURSE

A horizontal unit of wall, one masonry unit high.



WYTHE

A vertical unit of wall, one masonry unit thick.



QUOIN

A decorative treatment for the corner of the wall, consisting of brick or stone different from that used for the face of the wall.



THE BRICKS

STRETCHER



HEADER



SAILOR



SOLDIER



ROWLOCK



ROWLOCK STRETCHER or SHINER

THE BOND PATTERNS



RUNNING BOND

Only stretchers are used. Vertical joints are offset for strength. Easy to install, this is the most common bond used today.



STACK BOND

Only stretchers are used, but vertical joints are aligned. The weakest of the commonly used bonds, stack bond requires significant additional support.



COMMON BOND

Periodic header courses break up rows of running bond. The header courses require a cut three-quarter-length brick at the corners.



FLEMISH BOND

Each row alternates headers and stretchers. Multiple stretchers can come between headers: a pattern with three stretchers between headers is called garden-wall bond.



ENGLISH BOND

Rows of headers and stretchers alternate, with headers centred above stretchers and stretchers aligned vertically. The English cross bond or Dutch bond variation offsets the stretcher rows.



*A brick hod is used for carrying brick. In the wrong hands, it can be quite dangerous, and should only be hoisted by individuals of true strength and cunning.

WITH THANKS to Brian Trimble of the US Brick Industry Association.

Shifting spanner calliper

When drilling a hole for a nut-and-bolt assembly, quickly determine what size bit to use by tightening a shifting spanner around the bolt, then finding the drill bit that fits snugly into the jaws at that width.

Improve wireless router effectiveness

Wireless routers connect computers and an ever-growing list of vital home devices to the Internet and to each other, so when their signals get patchy it's a nightmare. Two quick improvements help. First, plug the router into a cheap electric timer set to briefly turn it off – effectively resetting it – every night while the house sleeps.

Then, on routers with multiple antennas, position the antennas perpendicular to each other. This provides the best chance for the wireless signal to align with devices' antennas.



Christmas tree coasters

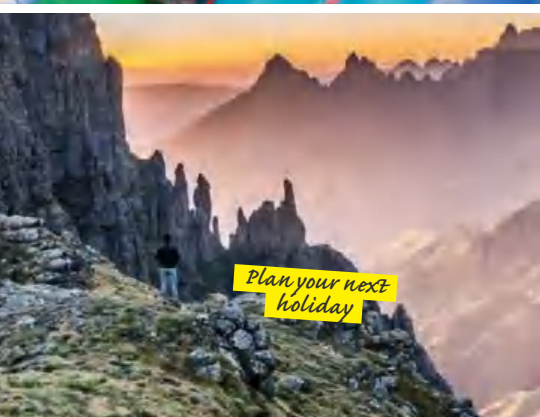
Contributing editor Richard Romanski cuts drink coasters from tree trunks. Use your Christmas tree to make your own – a fresh cut from the trunk will also keep it vibrant and healthy longer into the holiday season. An ideal coaster thickness is about a centimetre, so a cut about 20 centimetres off the bottom of the tree easily yields a full set. For stability, clamp the cut portion of the stump between two battens, then use the clamp as a handle to carefully slide it through a band saw. In time the wood's natural moisture will evaporate and the coasters will crack, but by then you'll have rung in the new year. **PM**



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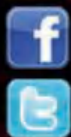
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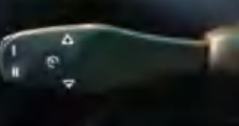
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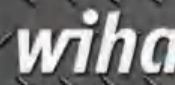
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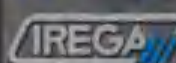
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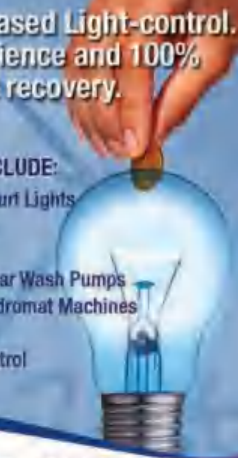
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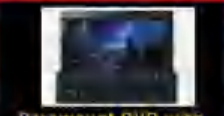
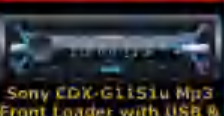
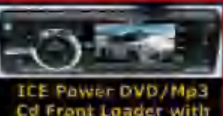
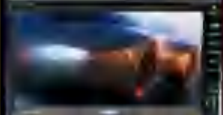
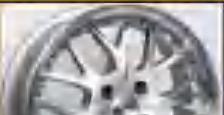
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185/60/14" - Prosport - R550	195/45/16" - Wanli - R720	215/35/18" - Accelera - R980	Bakkie and 4x4/SUV Tyres
185/60/14" - Pirelli - R650	205/45/16" - Kenda - R795	225/40/18" - Wanli - R895	195R14" - Wanli - R780
185/65/14" - Dunlop - R560	205/55/16" - Yokohama - R795	225/40/18" - Dunlop - R950	215/R15" - Dunlop - R1200
	205/55/16" - Dunlop - R780	225/40/18" - Yokohama - R1295	195R15C - Dunlop - R1050
	225/55/16" - Dunlop - R930	235/40/18" - Kenda - R1450	235/65/17" - Wanli - R1295
		255/35/18" - Wanli - R1150	175/40/20" - Achilles - R1995
			275/45/20" - Achilles - R1995

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WINNING TIP



COVER ALL THE ANGLES

I suddenly needed a cut-off machine for my 115 mm grinder. I could not find one in nearby stores, so had to improvise. Some scrap wood and two eyebolts did the trick. The photos say it all. The base can swivel 360 degrees, so you can cut at any angle.

JOHAN DE SWARDT
DURBANVILLE

WATERPROOF JOINTING ON THE CHEAP

Cut the appropriate size and length of plastic conduiting to slip over your cable. Stagger the length of your connection so that the joints do not overlap and form a thick connection. Connect each with a ferrule and tape them up individually. Then slip your piece of conduiting over the joints, leaving an overlap on each side. Finally, fill with silicone and seal it off on both ends to make a waterproof connection.

FRED HEYDENRYCH
KENSINGTON

POOL PUMP PLUMBING MADE EASY

If you are a swimming pool owner there will be a time when you have to repair or replace your pool pump. Quite often you will find a pump at a price you want to pay, but not the same fitting as the original. The plastic piping is easy to replace, the jointing being done by purchase of a special glue designed for joining plastic pipe work and making the joints waterproof under pressure. However, invariably you will find that the pipework to and from the pool is a "flexible" type of hose.

To refit the new plastic piping to such hose is an issue. The hose is clamped by means of a jubilee clip. First cut the old plastic pipe off the hose leaving a few centimetres sticking out. Remove the old

jubilee clip. Use a hacksaw blade to cut through the plastic pipe left in the hose and then break it out using a screwdriver.

You will now find it impossible to force the new plastic pipe into the old hose, but don't despair. Take the glue for sealing the plastic joints and smear it around the inside of the hose. Now, light that with a match or lighter!

In a couple of minutes the glue will burn off leaving the hose pliable enough to push the new plastic plumbing into the hose. Don't forget to put a new jubilee clip over the hose first. Tighten the clip over the newly made joint.

DAVE BELL
BENONI

POWER-SAVING CUPPA

A humble but effective electricity-saving tip for kettles, which use quite a lot of electricity: when you use the kettle first thing in the morning, fill it up and boil, use what you need, and put the rest in a flask. Later in the day, use the hot water for coffee without having to boil, or re-fill the kettle to quickly boil for tea. At super time, use the remaining water for cooking. This saves on stove time as it is still quite hot.

CAROL BAILIE
EDENVALE **PM**

SEND US YOUR HINT - AND SCORE!

Send us your best home, garage workshop and general DIY hints – and win! This month's winning tip will receive a Master Lock hamper worth R1 500. The hamper consists of a shackle key storage unit, keyed locking cable and M1 Excell Padlocks. The Shackle Key Storage Unit is a large key storage compartment that holds multiple house or car keys. It is secured by a four-digit resettable combination with dials mounted at an angle for easier use and good visibility. Its solid zinc body withstands hammering and sawing; dual locking levers and hardened steel shackle provide stern resistance to attempts at intrusion.

Weather-resistance measures include a protective plastic door and vinyl-coated shackle. The Keyed Locking Cable comprises a 1,8-metre self-coiling cable and pin tumbler cylinder. A vinyl cover protects your belongings from being scratched; it's available in blue, red and transparent.

Finally, the M1 Excell padlocks are built using the toughest boron alloy material and cutting-edge technology. Master Lock registered more than 40 patents to create Excell, a truly high-security padlock that is 50 per cent stronger than a standard padlock. In laminated steel and available in different sizes, it's perfect for indoor and outdoor applications, from securing factory fences to locking sheds or store front gates. For more information on Master Lock, visit mackiediy.co.za or call (021) 508 1250.

Send your tips to:

PM Do It Your Way, Box 180, Howard Place 7450, or e-mail popularmechanics@ramsaymedia.co.za. Please include your name, address and contact number. Regrettably, only South African residents are eligible for the prize. Prizes not claimed within 60 days will be forfeited.



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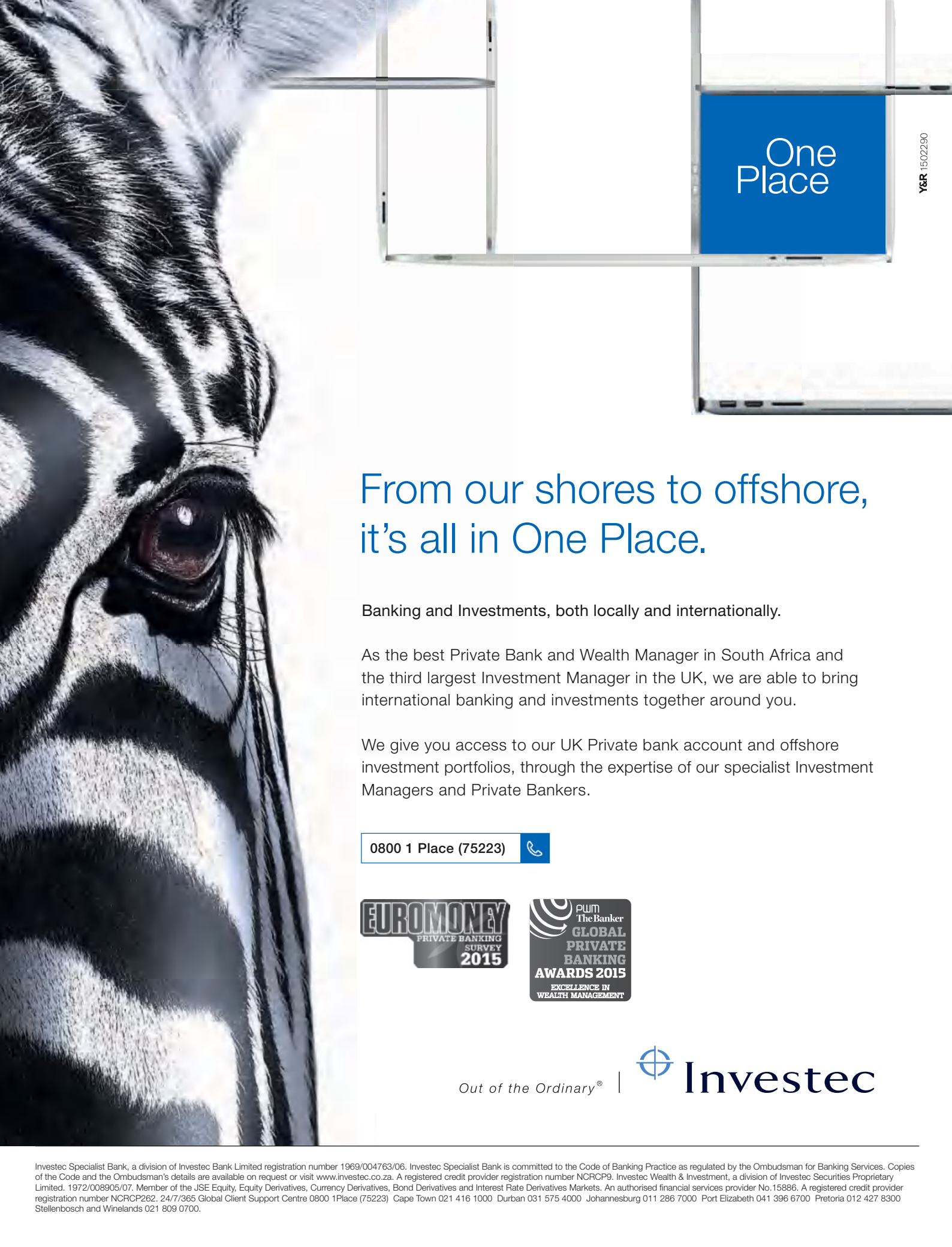


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